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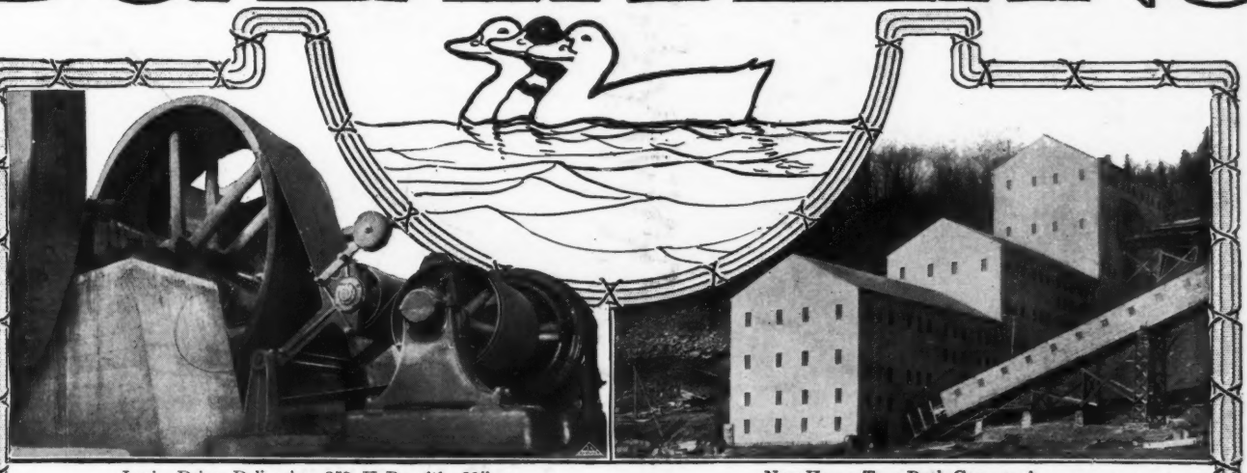

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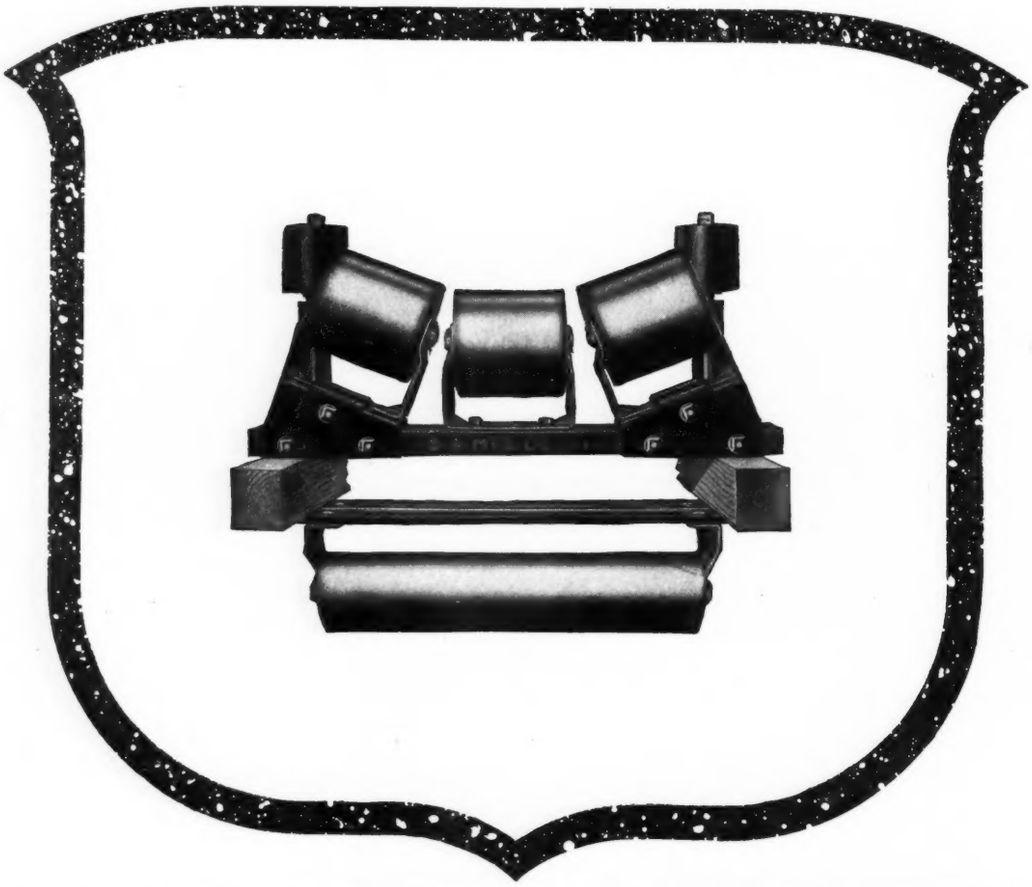

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Ammonia Leaching of Copper Tailings at Kennecott, Alaska

BY HORACE M. LAWRENCE*

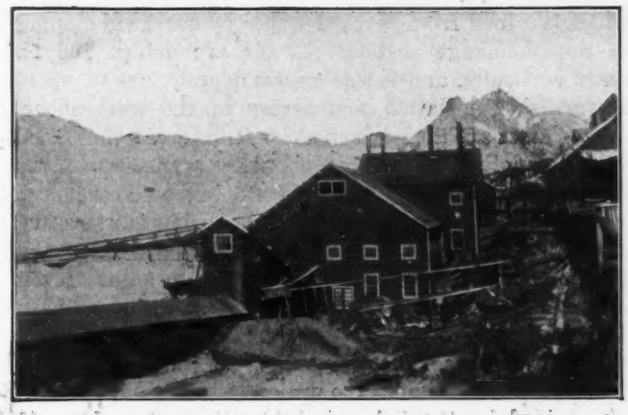
Leaching of tailings at Kennecott was preferred to flotation because of the greater concentration possible and consequent saving in freight and treatment charges. The ore, which occurs in limestone, contains about 8% Cu, of which an average of 36% is in carbonate form. The present 300-ton plant uses a 15-ft. leaching column and a steam wash preceded by water spraying. Plant now being increased to a capacity of 800 tons daily.

KENNECOTT, where some of the Alaskan properties of the Kennecott Copper Corporation are situated, is at the eastern terminus of the Copper River and Northwestern Ry., which extends inland 195 miles from Cordova, the seaport on Prince William Sound. At Kennecott, at an elevation of 2000 ft., are the offices and main works of the company, including the ammonia-leaching plant and the discharge terminals of the aërial tramways which connect the mill and railroad with the company's Bonanza and Jumbo mines. These, each about four miles away from the main plant, are at an elevation of 5870 ft. and 5740 ft. respectively.

Though Kennecott is only about 100 miles from the coast, the climate is dry. The winters are little colder than those of northern Minnesota and the temperature only occasionally goes below —30° F. For the months of November to March, inclusive, in 1915-16, the average mean temperature was 5° F. and the average minimum was —2° F., which was, if anything, colder than the usual winter season. Under these conditions, with a few refinements in operation to conserve water, maximum capacity is maintained throughout the year.

OCCURRENCE AND CHARACTER OF THE ORE

The orebodies at both the Bonanza and Jumbo mines occur in limestone close to its contact with an underlying greenstone series. These bodies are the result of the replacement of limestone by copper minerals along well-defined steeply inclined fractures approximately normal to the strike of the limestone beds, and also along bedding-planes in the limestone and in faults which cut them at a low angle. This replacement has resulted in three forms of orebodies: (1) Elongated vein-like bodies of a maximum width of 60 ft., dipping from 60° to 90° and cutting across the bedding-planes; (2) flat orebodies developed along bedding-planes or flat faults and dipping from 15° to 35°; (3) bodies at the intersection of the two forms above mentioned, where intense mineralization has resulted in large irregular orebodies, pear-shaped in plan. The two large deposits of almost pure chalcocite developed in the Bonanza and Jumbo mines belong to the third type. Up to date a large proportion of the milling ore has been mined from the vertical fissures. Table I gives an idea of the character of the ore:



AMMONIA-LEACHING PLANT AT KENNECOTT, ALASKA

TABLE I. SHOWING ANALYSIS OF BONANZA AND JUMBO ORES

Chemical Analysis		Mineralogical Analysis	
Cu*	7.99%	Chalcocite, Cu_2S	5.50
CaO	36.76	Covellite, CuS	1.23
MgO	10.4	Bornite, Cu_3FeS_4	0.13
Al_2O_3	0.15	Malachite $CuCO_3 Cu(OH)_2$	4.75
Fe	0.47	Dolomite $(Ca\ Mg)(CO_3)_2$	87.37
S	1.58	Hematite, Fe_2O_3	0.64
Insoluble	0.70	Miscellaneous Al_2O_3—Insoluble	0.85
CO_2	41.15		
H_2O	1.08		100.47
O	0.19		
	100.47%		

* 2.73% Cu in carbonate form.

Metallurgically, the ore may be looked upon as consisting of chalcocite and its oxidation products, malachite and azurite, in a gangue of gray limestone and dolomite. Covellite and enargite are found occasionally, and chalcopyrite and bornite are present in minute amounts with the other sulphides. The chalcocite occurs chiefly in seams and bunches in the limestone, permitting easy recovery by coarse crushing and water concentration. A small proportion of the chalcocite occurs intergrown with calcite, and requires fine crushing to

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liberate the sulphide. The occurrence of the other copper sulphides is similar to that of chalcocite, and in the absence of any heavy gangue mineral these offer no difficulty in concentration.

Malachite and azurite are found throughout the mines as oxidation products of the copper sulphides. The proportion of carbonate ore varies from 10 to 90% of the total copper value and for the ore developed to date has averaged 36%. A general decrease in the proportion of carbonate occurs with depth, although where intense fracturing has permitted free water circulation, the proportion of carbonate is as high as it is near the surface. The vertical orebodies, as a rule, contain a much greater proportion of carbonate ore than either the flat or intersection bodies. The rich chalcocite body of the Bonanza outcrop is of the intersection type, so the condition arises of slight oxidation on the surface in comparison with that found in the open vertical fissures at a depth of 900 ft. in the Bonanza mine.

Calcite occurs with the ore minerals in small amounts and, with limestone and dolomite, forms the gangue. The limestone and dolomite occurring in the orebodies are slightly iron-stained near the surface, but otherwise are generally fresh and unaltered, even in the center of wide orebodies.

Mining and Milling Methods

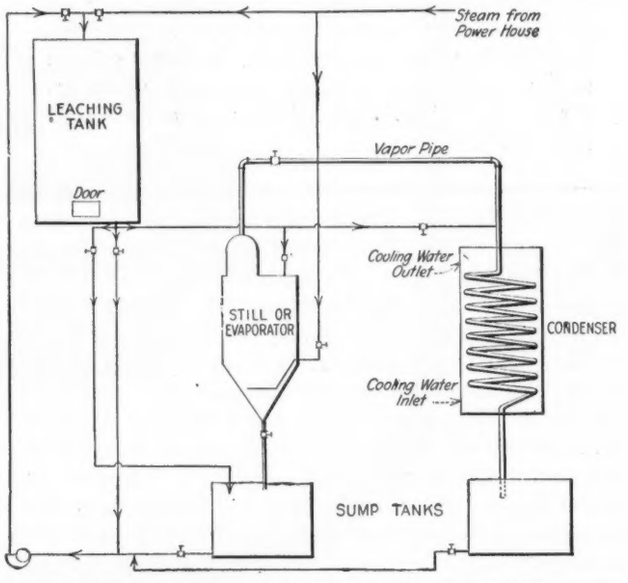
Most of the milling ore from the Bonanza and Jumbo mines is mined from vertical stopes by overhead stoping on the shrinkage system. Levels are driven 100 ft. apart vertically, and raises approximately 200 ft. apart to furnish ventilation and access to the level above. Chute-raises are then driven at 25-ft. intervals and holed into one another. The stope above the chute is then cut out to full width, and overhead stoping on broken ore continued to the level above. No timbering is necessary except at the chutes, due to the solid character of the limestone and the fact that the ground remains frozen the year round except on the levels close to the surface. Up to the present time no "horses" of waste have been found which cannot be left as stope-pillars.

At the Bonanza mine the ore close to the surface has been mined by the "glory-hole" method of underhand stoping and drawn off in chutes below the limits of the body. This method of "glory-holing" or "milling" is used on the flat-lying orebodies at both mines, and the broken ore drawn into the chutes by open-bottom scrapers.

In the mill the ore is broken to about four-inch size and hand-sorted to separate large pieces of sulphide and carbonate minerals from the leaner material. The remainder is then further crushed for concentration on jigs and tables. The coarse-crushing system consists of Blake-type jaw and Symons disc crushers with finer grinding in Traylor rolls. Coarse concentration on bull, Harz and Hancock jigs is followed by further treatment on Wilfley and James sand tables and James slimers. Sliming is avoided as much as possible, since the carbonate contents of the slimes are recoverable with difficulty except in a product too low for profitable shipment. Ninety-five to ninety-six per cent. of the sulphide and about 60% of the carbonate values are recovered in the mill. Part of the tailings are re-treated in the leaching plant, and the remainder stored for future handling.

The reasons for experimenting with leaching, rather than sulphide-filming and flotation as a further treatment of the mill tailings, were primarily the difference in the concentration ratio with the consequent difference in freight and treatment charges. By using sulphide-filming and flotation a concentrate greatly in excess of 30% Cu could not be expected, while the precipitates from ammonia leaching approximate 70% Cu. Alaskan freight rates, both rail and boat, are high, and the saving of a 70% product over a 30% product is more marked there than would be the case in a more accessible district.

The first experiments with ammonia leaching were conducted by the testing plant of the Federal Lead Co. in Flat River, Mo., in the winter of 1913-14. These tests were purely of a laboratory character, and no attempts were made to prevent the loss of ammonia. However, it was apparent that Kennecott ore would lend itself to ammonia leaching, as a satisfactory recovery was obtained. Consequently a small experimental plant, consisting of a leaching tank, still, condenser, and storage tanks, all of the simplest character, but designed



FLOW SHEET OF EXPERIMENTAL AMMONIA-LEACHING PLANT FIRST BUILT AT KENNECOTT

to be ammonia-tight and to give results somewhat comparable to those obtainable under actual operating conditions, was erected in the summer of 1914.

The experimental leaching tank provided for a leaching column of five feet, and ordinarily one-ton charges were leached. The ammonia still, or, more properly, evaporator, used direct heat in the form of live steam to distill off the ammonia and precipitate the copper from the copper-ammonia liquors, though occasionally, in an endeavor to diminish the volume of the waste solutions, indirect heat was used.

From the series of experiments conducted, it was concluded (1) that, with a heads assay of 1.2% carbonate copper, an extraction of 75% of the carbonate contents might be expected; (2) that, since the use of water to wash the tailings would prove impracticable, due to the fact that the final volume of solution would be large and that therefore the amount of solution to be distilled would prove excessive, a steam wash would be economical in point of time, amount of NH_3 recov-

ered, ultimate volume of solution to be distilled, and amount of steam consumed in the entire process. It was estimated that 100 lb. of steam per ton leached would be sufficient to wash the tailings to a point such that the ammonia retained in the residues would not exceed 0.25 lb. per ton leached; (3) that in the distillation of copper-ammonia liquors the steam used would not be more than 400 lb. per ton leached, the ammonia loss would not exceed 0.25 lb. per ton leached, of which amount the greater portion would be in a waste liquor or boiled-out solution assaying at a maximum 0.03% NH_3, and that precipitates assaying 70% Cu would be produced; (4) that other ammonia losses need not exceed 0.25 lb. per ton leached or a total ammonia loss of 0.75 lb. per ton leached.

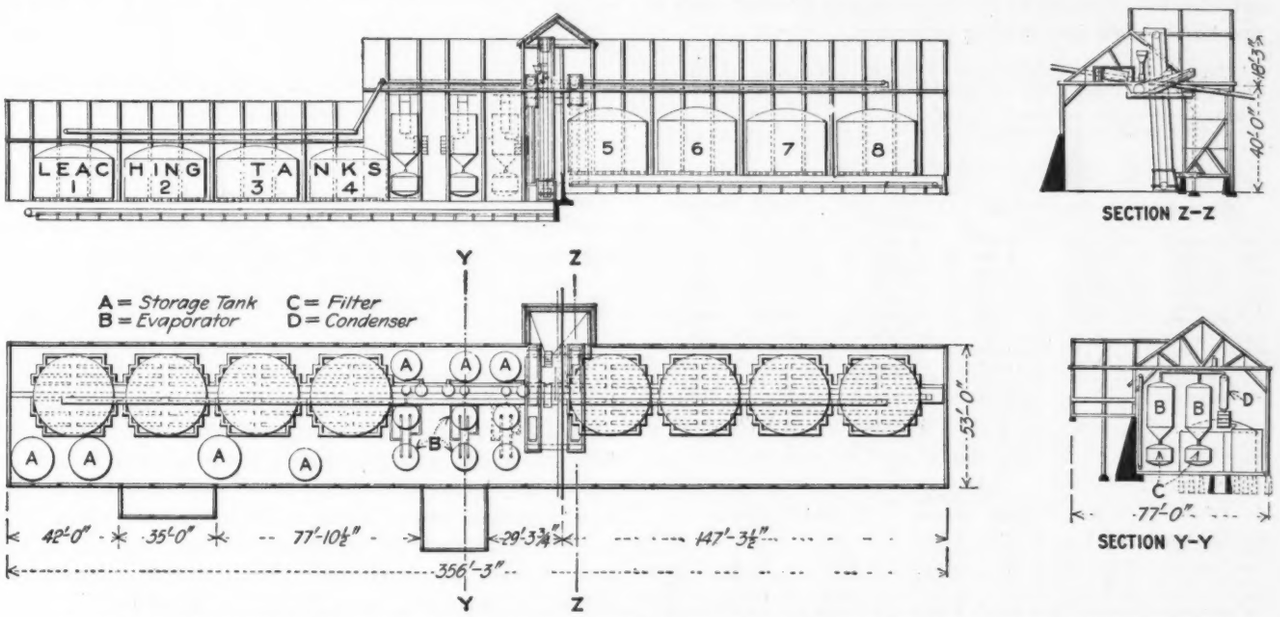
Description of 300-Ton Plant

In view of the results obtained with the experimental apparatus, a plant to have a daily capacity of 300 tons was erected. The leaching tanks, four in number and 30 ft. in diameter, with a leaching column 15 ft. high, were designed with a dome-top capable of withstanding a vapor pressure of 10 lb. They each have a capacity of 500 tons of mill tailings per charge. Before they are charged, the tailings are dewatered and partially deslimed. Were the material to be treated an oxide ore, such that dry crushing could be used in preparation for leaching, slime in reasonable amounts could be satisfactorily treated as there would be less tendency for it to segregate and interfere with the leaching and washing of the charges. For charging the tanks a revolving plate was provided to distribute the feed evenly over the whole area and to give a uniform mixture of coarse and fine material. After washing, the tailings are removed from the tank by a mechanical excavator through the bottom doors to a belt conveyor which carries them to the dump.

The distillation apparatus installed was of the continuous type. It consisted of an evaporator equipped with two salt filters, and surmounted by a standard ammonia concentrator or still. Connected with the top of the still was the usual condensing and absorbing system common to ammonia distillation. The distillation apparatus was designed to distill 100 tons per 24 hours of a solution assaying 6% NH_3, and to yield a waste solution containing not more than 0.02% NH_3. The above volume of solution was considered to be the maximum that would have to be distilled from the leaching of 300 tons of mill tailings containing 1.2% carbonate copper.

In March, 1916, operation commenced. From the first the expectations of a satisfactory extraction of the carbonate copper have been fully realized. Also the recovery of ammonia from the leached tailings, about which some uncertainty was felt, has proved to be as complete as the early experiments indicated. On the other hand, difficulties only partially foreseen were encountered in the distillation of the rich copper-ammonia liquors. Before operations had commenced the possibility of precipitates clogging up sections of the ammonia concentrator had been considered, but serious trouble was not anticipated as ammonia stills using lime to break up stable ammonia salts are regularly operated. Clogging, however, of precipitates in sections of the still occurred as soon as distillation commenced, accompanied by incrustations of a mixture of copper oxide and carbonate upon the walls and steam chest of the evaporator. This proved so serious that single-stage, continuous distillation was replaced by a two-stage process, wherein the primary operation reduced the rich solution from 4% Cu and 7.5% NH_3 to a filtrate assaying 0.4% Cu and 0.9% NH_3. This filtrate was then re-treated in a secondary operation to precipitate the balance of the copper and produce a waste solution assaying 0.025% NH_3.

After the plant had been in operation for some months, experiments with the idea of simplifying the distillation



PLAN AND SECTIONAL ELEVATIONS OF NEW 800-TON AMMONIA-LEACHING PLANT UNDER CONSTRUCTION AT KENNECOTT, ALASKA

Leaching tanks are shown with overhead distributing conveyor and tailings-discharge conveyor underneath. Section Z-Z shows mill-tailings launder leading to the 275-ton storage bins; also elevator to Vezin sampler. Section Y-Y shows absorber beneath the condenser

and securing an economy in steam consumption led to the installation of an evaporator of the periodic type. It is simpler in operation and, as no incrustation takes place on the walls or heating coils in the boiling chamber, its use avoids the frequent cleaning periods of the continuous system. Furthermore, the precipitates produced are of a higher copper content, and a considerable steam economy has been effected.

Absorption of CO_2 by Leaching Solution

The original lixiviant solutions contained little CO_2, as all ammonia was purchased in the form of aqua ammonia or ammonium hydrate, but, due to the absorption of CO_2, they soon became practically aqueous solutions of ammonium carbonate. The only objection thus far advanced to the presence of CO_2, is the slight increase in time necessary to secure a satisfactory extraction of the carbonate copper. To remove the large amount of CO_2 evolved from the circulating solution it has been found necessary to leave vents open in the top of the tank. The high leaching column has proved satisfactory, though 15 ft. is somewhat greater than is ordinarily used in leaching processes.

TABLE II. SCREEN TESTS AND COPPER CONTENTS OF HEADS AND TAILS OF AMMONIA-LEACHING PLANT

In any leaching process there is a shrinkage in the size of the particles during the leaching period, which is evident in the increased weights of the finer sizes in the tails.

HEADS

Size	% Wt.	% Carb. Cu	Lb. Carb. Cu In 100 Lb. of Sample	% Total	Cumulative
On 12 mm.	10.8	0.89	0.0958	9.0	....
On 9 mm.	21.6	0.96	0.2069	19.5	28.5
On 6 mm.	28.7	1.04	0.2978	28.1	56.6
On 2 mm.	26.9	1.10	0.2958	27.9	84.5
On 1 mm.	4.4	1.04	0.0456	4.3	88.8
On 40 mesh	2.8	1.36	0.0382	3.6	92.4
On 60 mesh	1.4	1.76	0.0246	2.3	94.7
On 100 mesh	1.3	1.48	0.0192	1.8	96.5
On 150 mesh	0.5	1.69	0.0085	0.8	97.3
On 200 mesh	0.5	1.39	0.0069	0.6	97.9
— 200 mesh	1.1	2.04	0.0225	2.1	100.0
Totals...	100.0	....	1.0618	100.0	.....

TAILS

Size	% Wt.	% Carb. Cu	Lb. Carb. Cu In 100 Lb. of Sample	% Total	Cumulative	H – T H
On 12 mm.	7.8	0.28	0.0218	9.0	....	68.6
On 9 mm.	18.5	0.23	0.0426	17.5	26.5	76.1
On 6 mm.	26.0	0.22	0.0572	23.6	50.1	78.9
On 2 mm.	29.9	0.19	0.0568	23.3	73.4	82.7
On 1 mm.	5.8	0.25	0.0145	6.0	79.4	76.0
On 40 mesh	4.4	0.33	0.0145	6.0	85.4	75.8
On 60 mesh	2.1	0.35	0.0074	3.1	88.5	80.2
On 100 mesh	2.3	0.36	0.0083	3.4	91.9	75.7
On 150 mesh	0.9	0.39	0.0035	1.4	93.3	77.0
On 200 mesh	0.9	0.41	0.0037	1.5	94.8	70.5
— 200 mesh	1.4	0.89	0.0125	5.2	100.0	56.4
Totals....	100.0	....	0.2428	100.0	....	77.1

As a result of a great deal of experimenting during the first months of operation, the following cycle has gradually been evolved and is the most satisfactory system tried up to the present.

Charging and Leaching

The dewatered and partially deslimed mill tailings are run into the tank by means of a chain-drag conveyor, which extends from the dewaterers over the top of the tanks. While charging, the drains are left open in the bottom of the tank, allowing the water that enters with the tails to filter through and escape. The leaching solution is pumped into the tank at the bottom, and rises through the charge, completely covering it. This solution contains enough concentrated ammonia from the stills or from the ammonia-storage tanks to dissolve the copper contained in the charge, and is diluted or mixed with enough rich copper-ammonia solution from a previous leach to give the mixture sufficient volume to cover the charge. In this case, the rich copper-ammonia solution acts merely as a vehicle for the "available" or uncombined ammonia and ammonium carbonate, and is not itself a solvent. Its use enables the charge to be covered without introducing an excessive amount of ammonia, or any fresh water into the tank, and keeps the distilling solution rich in copper.

The moisture remaining in the charge after the leaching solution has been turned in is displaced by the latter and rises, practically unmixed with it, to the top. Here a certain amount can be drawn off to waste without losing any of the leaching solution. The remainder of the moisture mixes with the solution, but is later removed from the system, together with the water introduced in the wash, as the effluent boiled-out solution from the ammonia stills.

TABLE III. ANALYSES OF HEADS AND TAILS OF LEACHING PLANT

	Heads, %	Tails, %
Cu	1.46	0.58
Cu. as carbonate	1.14	0.26
Fe	0.38	0.36
S	0.14	0.17
Insoluble	0.39	0.42
$CaCO_3$	72.82	72.20
$MgCO_3$	22.22	22.30

The leaching solution is next circulated downward through the charge, a small centrifugal pump returning the filtrate to the top of the tank. Circulation continues till tests show that it has ceased to dissolve copper, or for about 30 hours on the average.

Washing the Charge

The leaching solution is now drained off, part going to the evaporators, and part reserved as make-up for the next charge. While this rich solution is being drawn off from the bottom of the tank, about 20 tons of weak copper-ammonia solution is pumped on top of the charge as a preliminary wash and follows the rich solution down through the charge. When this weak solution begins to appear at the bottom of the tank, the effluent is turned over from the rich-solution storage tank to the wash-solution storage tank.

Immediately following the preliminary wash comes the steam wash. Steam is admitted at the top and gradually heats the charge to the bottom. Pressure in the tank is kept below 5 lb. per sq.in. to avoid distorting the tank and subsequent leakage. The incoming steam condenses in heating the charge, so that a film of condensed water precedes the steam down through the tank, displacing most of the copper-ammonia solution. The remainder of the ammonia, volatilized by the steam, is carried out with it after it reaches the bottom openings in the tank, and is recondensed in a special condenser. This weak ammonia solution is saved in the wash-solution storage tanks.

When the ammonia content of the vapors issuing from the tank has fallen to 0.5% NH_3, the wash is considered finished, the steam is shut off and the tank excavated with mechanical excavators, as hereinafter described. The time necessary for steam washing, when carried out in connection with the preliminary wash with weak solution, will average 20 hours per charge, and the steam used amounts to only about 100 lb. per ton of material leached.

The steam wash is the greatest single factor in making the Kennecott leaching a success, and upon this portion of the process a patent has been granted. This method of washing enables one to leach rich ores with concentrated ammonia solutions, without incurring an excessive ammonia loss in the tailings, or without using a large volume of wash water, probably several times the volume of the leaching solution, instead of 20% of it as with the steam wash. A water wash is undesirable; first, because water consumption at Kennecott is no small consideration, and also because a large volume will dilute the distilling solution, thereby increasing the cost of distillation proportionately. In fact, the steam economy arising from distillation of solutions which contain upward of 4% copper more than counterbalances the steam used for the wash. In addition, there is the advantage that these rich solutions have little tendency to encrust the walls of the evaporators and stills. This is a point all operators are well able to appreciate.

As water for sluicing is not available at Kennecott and as the shape of the leaching tanks permits only about 35% of the charge to run out by gravity, a mechanical excavator has been designed and installed in the tanks. It consists of a central shaft supporting four radiating arms carrying blades which scrape the tailings to the center doors as the shaft revolves. It removes the tailings from the tank in about seven hours, using only 1½ hp. and requiring practically no attention.

In the present plant the tonnage of mill tailings leached has been gradually increased from 3000 tons in April, 1916, to 10,000 tons in April, 1917. The ammonia loss, at first excessive, has decreased from 2.6 lb. to 0.5 lb. per ton leached. The extraction has varied somewhat but has averaged better than 75% of the carbonate copper. The grade of precipitates has varied markedly but has averaged practically 70% Cu. In Table IV are the monthly summaries of results obtained in the operation of the plant from April, 1916, to April, 1917, inclusive.

In view of the results obtained, construction work has already commenced on the enlargement of the plant to one of a capacity of 25,000 tons per month. The four new leaching tanks are to be 30 ft. in diameter, the same as the present tanks, but are to be 5 ft. higher, thereby increasing the leaching column from 15 to 20 ft. and the capacity from 500 to 665 tons per charge. The four evaporators, which are periodic in type, are to be arranged in two double-effect units, each unit being equipped with a separate condenser and absorber. Arranging the evaporators in double effect will economize the steam used, as a higher grade ammonia con-

TABLE IV. DATA SHOWING OPERATION FOR 13 MONTHS AT THE KENNECOTT AMMONIA-LEACHING PLANT

Month, 1916	Heads: % H_2O	Heads: Av. Tons per Chg.	Heads: Carbonate Cu: %	Heads: Carbonate Cu: Tons per Chg.	Leaching Solution: Tons per Chg.	Leaching Solution: Ratio to Chg.	Leaching Solution: % Cu	Leaching Solution: % NH_3	Percolation per Hour: In.	Percolation per Hour: Gal.	Time Hours	Tailings: % Carb. Cu	Extraction: % Calc. Carb. Cu	Extraction: Lb. Cu per Ton	Precipitates: Assay % Cu	Tailings Wash: Av. Hours per Chg.	Tailings Wash: Depth of Chg. Ft.	Tailings Wash: Rate of Washing In per Hr.	Tailings Wash: Final Condensate % Cu	Tailings Wash: Final Condensate % NH_3
April	5.6	569	1.50	8.54	218	1:2.6	0.33	5.24	29	4,050	..	0.33	78.2	20.0	72.0	40	15.25	4.58	0.03	0.35
May	6.3	509	1.53	7.79	174	1:2.9	0.33	4.99	24	3,350	38	0.41	73.4	22.3	69.7	27	14.83	6.60	0.02	0.26
June	6.3	474	1.26	5.98	145	1:3.3	0.28	5.56	22	3,075	28	0.42	66.8	16.9	68.2	33	14.63	5.31	0.04	0.38
July	6.2	483	1.12	5.43	149	1:3.2	0.20	5.25	22	3,075	32	0.34	69.6	16.1	71.3	36	14.83	4.94	0.04	0.43
August	5.9	505	1.14	5.76	160	1:3.2	0.77	6.09	24	3,350	32	0.27	76.3	17.5	67.5	36	14.85	4.95	0.04	0.45
September	6.8	518	0.91	4.70	152	1:3.4	0.20	5.53	26	3,630	32	0.18	80.5	14.6	66.6	32	14.96	5.79	0.04	0.41
October	6.1	533	1.05	5.62	180	1:3.0	1.18	7.25	29	4,050	37	0.22	79.2	16.7	70.4	27	14.83	6.61	0.05	0.40
November	6.0	534	1.03	5.50	192	1:2.8	1.53	8.35	27	3,770	29	0.20	80.7	16.6	73.1	32	14.83	5.57	0.05	0.48
December	5.5	539	0.85	4.59	143	1:3.7	1.87	6.67	28	3,910	31	0.20	76.7	13.1	71.8	30	15.00	6.00	0.05	0.42
Average	6.1	515	1.11	5.70	164	1:3.14	0.78	6.30	26	3,630	32	0.27	75.7	16.9	69.9	32	14.89	5.68	0.04	0.40
Jan., 1917	5.5	533	1.03	5.48	167	1:3.19	2.02	7.39	30	4,190	27	0.27	73.9	15.2	69.2	24	14.84	6.19	0.05	0.48
February	4.5	543	0.95	5.11	143	1:3.80	1.43	7.38	29	4,050	32	0.23	75.8	14.6	70.3	25	15.08	7.24	0.05	0.48
March	4.9	523	1.08	5.66	143	1:3.66	1.46	7.66	30	4,190	33	0.24	77.8	16.1	70.1	27	14.96	6.65	0.04	0.44
April	5.1	516	1.01	5.21	156	1:3.31	1.60	8.13	38	5,310	32	0.27	73.3	14.3	67.5	26	14.63	6.76	0.04	0.47

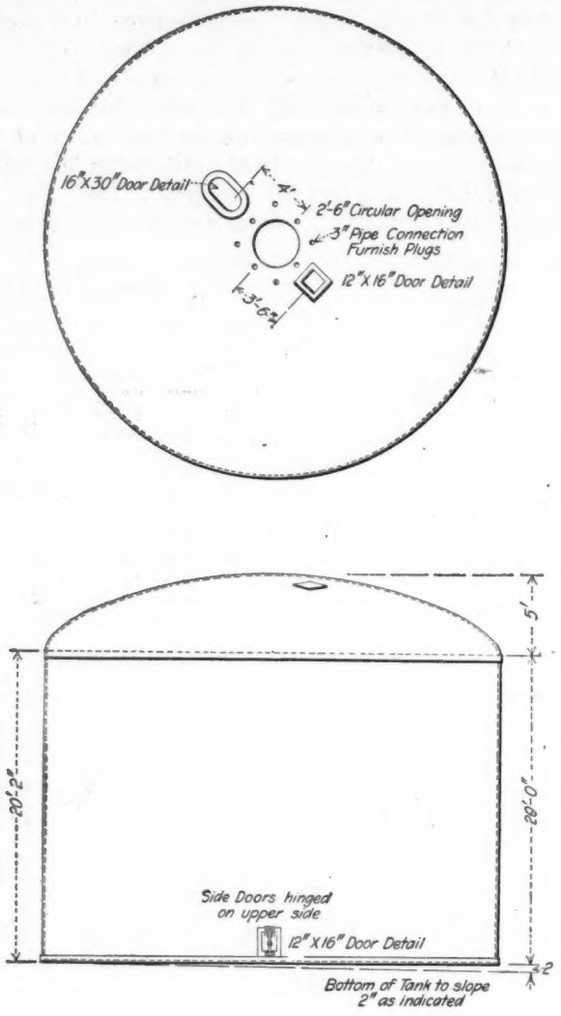
Details of the Distillation of the Copper-Ammonia Solutions

Month, 1916	Solution to Still: Tons per Chg.	Solution to Still: % NH_3	Solution to Still: % Cu	Solution to Still: Ratio NH_3 to Cu	Boiled Out Solution: Tons per Hr.	Boiled Out Solution: Tons per Chg.	Boiled Out Solution: % NH_3	Boiled Out Solution: Av. Tons NH_3 per Chg.	Boiled Out Solution: Ratio B.O.S. to S.T.S.	Concentrate: Tons per Chg.	Concentrate: % NH_3	Concentrate: Ratio of Conc.	Details of Still Operation: Primary Still: Filtrate % NH_3	Primary Still: Filtrate % Cu	Primary Still: % Total NH_3 Dist.	Primary Still: % Total Cu Ppt.	Primary Still: Assay Ppt. % Cu	Secondary Still: Filtrate % NH_3	Secondary Still: Filtrate % Cu	Secondary Still: % Total NH_3 Dist.	Secondary Still: % Total Cu Ppt.	Secondary Still: Assay Ppt. % Cu
April	351	3.51	2.04	1.72:1	3.33	147	0.06	0.090	0.42:1	108	9.33	2.66	0.58	0.32	81.8	91.0	72.0	....	....	....	....	....
May	211	4.10	2.94	1.39:1	3.59	172	0.05	0.079	0.82:1	87	8.79	2.14	0.94	0.69	71.9	76.7	68.4	0.049	0.01	16.6	14.7	76.2
June	143	5.27	3.10	1.70:1	3.46	133	0.03	0.037	0.93:1	68	10.29	1.95	0.98	0.56	79.9	74.5	67.5	0.028	0.0	12.9	12.6	76.6
July	141	5.27	2.88	1.82:1	3.52	136	0.03	0.036	0.97:1	60	11.40	2.16	1.00	0.52	77.3	83.8	70.3	0.027	0.0	14.7	13.6	77.1
August	142	5.40	3.19	1.70:1	3.85	135	0.02	0.032	0.95:1	61	11.69	2.16	1.00	0.44	79.1	84.3	66.6	0.024	0.0	13.9	10.4	76.3
September	145	5.65	2.76	2.05:1	3.90	142	0.01	0.021	0.98:1	68	11.56	2.05	0.94	0.40	84.3	83.4	66.1	0.015	0.0	12.7	11.9	75.6
October	113	6.82	3.80	1.79:1	3.14	138	0.02	0.022	1.22:1	65	11.58	1.70	0.91	0.41	85.9	87.0	69.6	0.016	0.0	12.1	9.7	77.0
November	103	8.11	4.34	1.87:1	2.62	127	0.02	0.026	1.24:1	55	15.00	1.85	1.01	0.46	87.3	87.4	72.8	0.020	0.0	11.3	10.5	76.2
December	70	6.65	4.47	1.49:1	2.26	89	0.03	0.031	1.27:1	39	11.75	1.77	0.78	0.27	86.3	89.4	71.5	0.017	0.0	12.2	7.1	76.3
Average	139	5.54	3.19	1.74:1	3.32	132	0.03	0.035	0.95:1	64	11.33	2.05	0.90	0.45	81.5	84.2	69.2	0.025	0.0	13.3	11.3	76.4
Jan., 1917	86	7.50	4.85	.....	2.26	104	0.019	0.020	1.21:1	57	10.83	1.45	0.84	0.28	87.6	91.8	68.7	0.015	0.0	10.6	4.8	76.1
February	90	7.24	4.32	.....	2.09	114	0.022	0.025	1.27:1	58	11.17	1.54	0.79	0.23	87.2	95.8	70.1	0.018	0.0	12.2	6.3	74.6
March	91	7.46	4.67	.....	2.02	96	0.022	0.021	1.05:1	55	12.19	1.65	0.72	0.20	90.0	94.3	69.9	0.015	0.0	8.8	4.7	76.7
April	82	7.95	4.61	.....	2.22	109	0.018	0.020	1.33:1	51	12.62	1.59	0.78	0.24	83.1	88.6	66.7	0.016	0.0	15.7	8.9	75.0

Month 1916	Ammonia Lost: Tons per Chg.	Lb. per Ton Leached: In Tails	Lb. per Ton Leached: In B.O.S.	Lb. per Ton Leached: Est. Misc.	Lb. per Ton Leached: Total	% Distribution: In Tails	% Distribution: In B.O.S.	% Distribution: Est. Misc.	Steam Consumption: For Tailings Wash: Tons per Chg.	For Tailings Wash: Lb. per Ton Lchd.	For Tailings Wash: % of L.S.	For Tailings Wash: % of Chg.	Distillation: Tons per Chg.	Distillation: Lb. per Ton Lchd.	Distillation: Tons per Ton S.T.S.	Distillation: Lb. per Lb. NH_3 in S.T.S.	Distillation: Lb. per Lb. Cu Ppt.	Grand Total: Tons per Chg.	Grand Total: Lb. per Ton Lchd.	Grand Total: Lb. per Lb. Cu Ppt.
April	0.74	0.17	0.32	2.10	2.59	6.6	12.4	81.0	35	122	15.9	6.2	188	662	0.54	15.3	32.3	223	784	38.3
May	0.67	0.15	0.31	2.19	2.65	5.7	11.7	82.6	29	114	16.6	5.7	102	399	0.48	11.7	18.3	131	513	23.4
June	0.51	0.23	0.16	1.76	2.15	10.7	8.4	81.9	30	126	20.7	6.3	96	406	0.67	12.7	25.7	126	532	33.7
July	0.36	0.26	0.15	1.08	1.49	17.5	10.7	72.5	33	136	22.1	6.8	97	402	0.69	13.0	24.4	130	538	32.7
August	0.23	0.27	0.13	0.51	0.91	29.7	14.3	56.0	33	131	20.6	6.5	93	368	0.66	12.1	21.7	126	499	29.4
September	0.26	0.25	0.08	0.67	1.00	25.0	8.0	67.0	35	135	23.0	6.8	94	363	0.65	11.5	25.5	129	498	35.0
October	0.23	0.24	0.08	0.52	0.84	28.6	9.5	61.9	35	133	19.7	6.7	93	348	0.82	12.0	22.3	128	481	30.7
November	0.23	0.29	0.10	0.49	0.88	33.0	11.4	55.6	39	146	20.3	7.3	91	341	0.88	10.9	20.7	130	487	29.6
December	0.21	0.25	0.12	0.41	0.78	32.1	15.4	52.5	37	137	25.9	6.9	59	219	0.84	12.7	19.0	96	356	30.9
Average	0.34	0.26	0.14	0.92	1.32	19.7	10.6	69.7	34	132	20.7	6.6	95	369	0.68	12.3	23.0	129	501	31.3
Jan., 1917	0.22	0.29	0.08	0.46	0.83	34.9	9.7	55.4	26	98	15.6	4.9	83	312	0.96	13.2	20.6	109	410	27.0
February	0.23	0.29	0.09	0.47	0.85	34.1	10.6	55.3	25	92	17.5	4.6	88	324	0.98	13.5	22.2	113	416	28.5
March	0.19	0.27	0.08	0.38	0.73	37.0	10.9	52.1	25	96	17.5	4.8	85	325	0.93	12.5	20.2	110	421	26.1
April	0.13	0.28	0.08	0.14	0.50	56.0	16.0	28.0	27	105	17.3	5.2	80	310	0.98	12.3	21.7	107	415	29.0

B.O.S.—Boiled Out Solution. L.S.—Leaching Solution. S.T.S.—Solution to Still.

centrate can be produced. By the new arrangement the ammonia concentrate will assay at least 18% NH_3. This will effect a saving of 22% in the steam used for distillation. Should the heads for any extended period assay considerably above the present feed, the amount of solution to be distilled would exceed the capacity of the evaporators, so a third unit has been provided for.

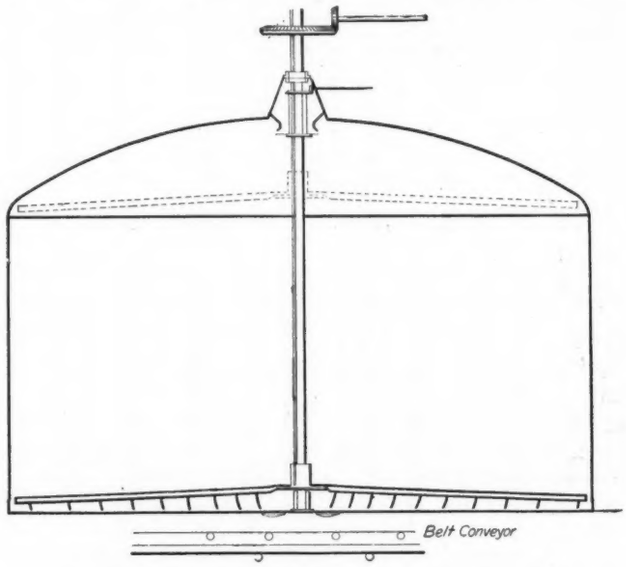


DETAILS OF AMMONIA-LEACHING TANK USED AT KENNECOTT

In the accompanying illustrations are shown drawings of the new leaching tanks and the general arrangement of the apparatus in the enlarged plant.

Based upon the figures of the present 300-ton plant, the cost of treating 800 tons per day by ammonia leaching, assuming a heads assay of 1% carbonate copper and a recovery in the precipitates shipped of 75% of the carbonate copper in the heads, is given below. Of the costs, other than the freight and treatment charges on the precipitates shipped, which need not be considered here, the figures for steam, ammonia, and labor are, in the order given, the most important.

The cost of steam for the operation of an ammonia-leaching process will vary with the grade of material treated, since the steam required for the distillation of the copper-ammonia liquors is practically constant per pound of copper precipitated. On the other hand, the steam necessary for the tailings wash is a factor of the tonnage treated, averaging, say, 100 lb. per ton. Assuming a heads assay of 1% carbonate copper and a recovery in the precipitates of 75%, there



SKETCH SHOWING EXCAVATOR SHAFT AND DRIVING MECHANISM

TABLE V LABOR COSTS OF AMMONIA LEACHING

	No. of Shifts per 24 Hours	Rate per Shift Exclusive of Bonus	Amount per 24 Hours
Foreman and chemist	1	$6.00	$6.00
Shift bosses	3	4.50	13.50
Operators, distillation	3	4.00	12.00
Operators, charging tanks	3	3.75	11.25
Operators, tailings disposal	3	3.75	11.25
Operators, sacking and loading precipitates	3	3.75	11.25
Maintenance	2	4.50	9.00
Firemen (for boilers)	3	4.00	12.00
Roustabouts	3	3.75	11.25
Totals	24	....	$97.50

or on a basis of 700 tons per 24 hours the cost per ton would be 13.9c.

Miscellaneous:

Electrical power, compressed air, lights, etc	4c. per ton leached
Maintenance—supplies and equipment	9c. per ton leached
Sacking precipitates—expenses other than labor	1½c. per ton leached
Sampling, assaying, experimental, etc	4c. per ton leached
Miscellaneous	5c. per ton leached

Summary:

	Cost per Ton Leached	Cost per Lb. Cu Recovered
Steam	33.6c.	2.24c.
Ammonia	17.0	1.13
Labor	13.9	0.93
Electrical power, etc	4.0	0.27
Maintenance	9.0	0.60
Assaying, etc	4.0	0.27
Miscellaneous	5.0	0.33
Totals	86.5c.	5.77c.

would be produced 15 lb. of copper per ton of material treated. With the steam necessary for the distillation amounting to 18 lb. per lb. of copper precipitated, there would be required 270 lb. per ton leached, and with the 100 lb. for the tailings wash, the total steam consumption would be 370 lb. per ton leached. With a net evaporation of 11 lb. of water per lb. of fuel oil, and with oil at $3.25 per bbl. (42 gal.), the cost of steam per ton leached would be 33.6 cents.

The ammonia used at Kennecott is aqua ammonia, or ammonium hydrate, containing 29.2% NH_3 (26° Baumé at 60° F.). This form of ammonia is more convenient to handle and costs less per lb. of NH_3 delivered at Kennecott than does the anhydrous ammonia. The cost per lb. of NH_3, including the return freight on the empty drums, is 34c. With an ammonia loss of 0.5 lb. per ton leached, the cost will be 17 cents.

The costs given in the above tabulation are those estimated for the Kennecott plant when enlarged to have a capacity of 800 tons per day, though to make the costs liberal the labor figures are based on a 700-ton capacity.

Government Operation of Mines

By Frederick F. Sharpless*

It is to be hoped that the production of coal and metals for the use of the Government and the public generally may be maintained at such a high level that the occasional suggestion of Government-operated mines may not become a reality or may not have to be seriously considered. With a Government inadequately equipped for handling the multitude of new problems daily presented to it—problems that are national in character and must be solved by it—the additional responsibility of operating a large number of metal and coal mines would be a burden of serious moment.

Government Operations will not be Cheaper

That the Government, as manager, could operate any better or more cheaply is to be doubted; it certainly could not by placing properties in new and untrained hands. If taken over, the mines would, in most cases, have to be operated by their present forces at an expense which certainly would not be less than without Government intervention. Having fixed the price of metals and coal, having regulated the freight rates to be charged, there remains but one important element for the Government to regulate, that is, the compensation to be paid to labor. It is true that with Government ownership or Government operation it would be in a position to dictate as to the price to be paid for labor, but that it would dictate any terms whereby the cost of production would be reduced is not probable.

Dictation between labor and the Government has always, heretofore, come from the other side. It would probably be no different now. In order to stimulate production it would probably increase the price of labor, and increase correspondingly the price of the commodity to itself and the public. There is a way, however, of avoiding the continual rise in prices and of maintaining production if not stimulating it, a way that is just and is, or can be made, legal, that is, the conscription of labor. Whether it is yet time for it or even time to talk about it is questionable, and yet it is a possibility.

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Probably the most important factor endangering the success of our present national undertakings is that portion of the laboring element which is not only refusing to coöperate with the Government but is also absolutely blocking its program. Congress, backed by national demand, quickly passed the selective-draft law, enabling the Government to select all the physically fit men between the ages of 21 and 31, from all classes and walks of life, and to demand that they bear arms, carry our flag to the front and, if necessary, die in the attempt to make that flag the symbol of right and justice.

The best brains of the country have volunteered or been drafted to help in the work. The Government is taking supplies and practically dictating the terms on which they are taken. Money for the expenses of prosecuting the war, or a large portion of it, will be taken from those who have it on conditions determined by Congress. All these are requisitioned, not regardless of the rights and duty of the individual, but with due consideration of all his rights and obligations.

Conscripted Industry Needed to Back Army

A successful army will have something more than its trained troops. The latter will be backed not only by brains, money and supplies but also by an army of labor, freely given, it is to be hoped, but forced if necessary. If a canvass of labor were possible, it would doubtless be found that the large majority of workers are in dead earnest about winning the war and ready to help to the limit in office, field or factory; but the spirit of strikes spreading over the country indicates that a considerable percentage of labor is interested in the war only to the extent of securing the maximum wage for a minimum of service.

Such individuals will probably not cease to strike and demand ever-increasing wages and shorter hours, but there is not money enough in the country to buy loyalty to the flag from men of that stripe. We have drafted brains, supplies, money and men when they have not volunteered—labor alone has not been called. This does not mean that labor is slacking, that it is not now doing a big share. There are thousands of men and women, yes millions of them, who are doing their very best. It is not this labor that is referred to, but that relatively small portion of it, earnestly needed by the Government, which says, "Do thus and so, or we quit."

We have drafted men to support the flag, or to die for it, at $1 per day and board. Can we not call the mechanic to do the work for which he is fitted (without the dying) at the same figure or even at normal wages? Certainly justice to the one sent to the front demands support at home, not continued argument respecting rates and hours. Injustice or class legislation cannot be the arguments opposed to the idea.

When a drafted man leaves his family to care for itself and gives up his occupation for some one else to follow, his ardor of going is somewhat dampened when he sees his neighbor, with some slight physical defect going to work as a carpenter's helper at $7 per day or handling a pick and shovel at 50c. per hour when he was never known to be worth more than $1.50 per day. It is with a rather better feeling that the enlisted man sails, while watching the stevedores who have struck, no matter what the cause, while the soldiers' supplies and supply ships lie idly waiting the laborers' pleasure. Is

it possible that some of those idlers realize how near their action, their crime, comes to manslaughter? Probably a few of them do; probably the majority do not.

The enlisted man does not want in his company those who are happy to have been rejected, but he has a right to hope for and to expect unlimited support from all those who are unable or afraid to accompany him. Argument is unavailing with such men as are responsible for many of the strikes. They are not many but their influence has been powerful. The American soldier knows that the greater portion of labor is supporting him, he wants to know that all of it is supporting him. He would like to know that it is acting of its own free will, but if there is a lack of free will, he would like to know that it is forced to do its part by the Government in whose care he has placed himself, whose resolutions he is trying to make good, whose war he will win even though it may mean his death.

McIntyre-Porcupine Report

The latest report of the McIntyre-Porcupine Mines, Ltd., of Schumacher, Ont., covers the period of 15 months ending June 30, 1917, for the reason that the date of closing of the fiscal year has been changed from Mar. 31 to a time when the absence of snow facilitates the taking of inventories of supplies.

Of the authorized capital of 4,000,000 shares 3,610,283 are now outstanding with a par value of $1 each. The acquisition of the outstanding minority interests in the McIntyre-Extension and the McIntyre-Jupiter properties involved the issue of 294,000 and 316,298 shares respectively. The fixed assets of the company are now reported as $4,432,249, of which $3,617,254 represents mining properties and $814,995 the buildngs, machinery and equipment. The total assets are placed at $4,851,780 and include some Dominion Government 20-year 5% War Loan bonds and a $100,000 investment in Plenaurum Gold Mines, Ltd., a property adjoining the Jupiter mines. Current liabilities are set down as $87,597, outstanding first mortgage 7% gold bonds $11,000, depreciation and general reserves $400,996, giving with the outstanding stock issue total net liabilities amounting to $4,109,876. There remained on the books on June 30, 1917, a surplus of $741,903, subject to a future slight deduction to provide for the business-profits war tax for 1916-1917.

During the period the ore broken in stopes was 215,240 tons, ore broken in development 21,160 tons, ore hoisted 193,986 tons. Development work amounted to 8454.2 ft. Prior to Apr. 1, 1916, the total footage was 25,676.6 and the bringing of 10,544 ft. of workings of the absorbed properties into the records of the amalgamated company makes a total footage of 44,675 on June 30, 1917. Diamond-drill operations from the underground levels showed interesting results. One hole penetrated 19 ft. of $25.30 ore at 1387 ft. from surface, another penetrated 12½ ft. of $8.20 ore at 1160-ft. depth, and another 7½ ft. of $13.50 ore at a depth of 785 ft. from surface and 60 ft. west of the Plenaurum.

Operating costs are reported as: Exploration $0.0487 per ton; development $0.8085; breaking and stoping $2.1348; crushing and transportation of ore $0.1184; milling $0.8882; repairs to buildings, etc., $0.0512; heating, lighting, water supply, etc., $0.1248; executive expense at head office $0.0649; administrative and general expense at mine office $0.2266; taxes, insurance and workmen's compensation $0.2104; bullion marketing costs $0.0525; and miscellaneous incidental to amalgamation $0.0543; or a total of $4.7833 per ton. The mill treated a total of 195,307 tons of ore (16,286 from subsidiaries previous to amalgamation Jan. 1, 1917) at a cost of $0.887 or 8c. per ton lower than for the preceding period.

The main shaft has been equipped with 2½-ton skips and ore and waste pockets cut out below the 1000-ft. level. Ore passes will carry all the ore from workings on the 600-ft. level to the 1000-ft. level, where it will be hauled to the shaft by electric storage-battery engines. An electric hoist, a 30-drill electric-driven compressor, a 100-ton-per-hour crushing plant, and an 800-ton ore bin were also added to the plant at the main shaft. Various improvements were made at the Jupiter shaft, and new equipment was added to the mill. The total expenditure for additions to plant and equipment was $229,527, which includes $99,040 for additions to the absorbed properties prior to Jan. 1, 1916. After mining and treating ore of a gross value of $1,954,793 during the period the ore reserves have been increased to 443,617 tons with an average value of $11.14 per ton.

Colorado Oil Shale Industry

At various times in the past there have been published in the *Journal* some descriptive articles[1] concerning the oil shale deposits of northwestern Colorado, southwestern Wyoming and northeastern Utah, activity in exploration work being centered near De Beque, Colo., a station on the main line of the Denver & Rio Grande railroad, 417 miles from Denver and 328 miles from Salt Lake City.

During the last year development work in the district has been somewhat active and several companies have been formed for the purpose of exploitation. The American Shale Refining Co., organized by Denver men, is building condensers and furnaces to be installed at De Beque and is expected to reach an output of 6000 bbl. of crude oil per day. A new process, protected by patents, provides for automatic movement of the shale and extraction of the oil in less time than by old methods. Other shale-oil companies incorporated in Denver are the Colorado Carbon Co., Mt. Logan Oil Shale Mining and Refining Co., Glenrock-De Beque Oil and Gas Co., Oil Shale Mining Co., Colorado Shale Products Co., Ute Shale Oil Co., Battlement Oil Shale Co., and the Book Cliff Oil Shales Co. Prominent in the directorate of several of the new shale companies is B. J. Barron, an official of the Midwest Oil Co. and of the Boston-Wyoming Oil Company.

Field examinations and experiments have led to the belief that in Colorado alone there is enough shale to produce 20,000,000,000 bbl. of oil and that 300,000,000 tons of ammonium sulphate can be recovered as a byproduct in the manufacture of the oil. It is further estimated that by ordinary means of refining some 200,000,000 bbl. of gasoline may be extracted from the oil in the Colorado shale.

[1]Vol. 98, No. 3, p. 133, July 18, 1914; Vol. 99, No. 18, p. 773, May 1, 1915; Vol. 102, No. 24, p. 1011, Dec. 9, 1916.

Production of Electrolytic Antimony From Impure Ores

By WILLIAM A. BURR*

The stringent specifications of buyers as to purity of antimony prohibits the working of many impure ores. After many experiments a profitable method was developed of reducing such ores by grinding to eight mesh and leaching with a solution containing 7% sodium hydrate and 2% sodium chloride. From the solution antimony was precipitated electrically. Steel electrodes and a current density of 8-9 amp. per sq.ft. at 2¼-2½ volts pressure were used. The precipitate contained 99.94% Sb.

SEVERAL years ago I became interested in the mining of antimony ores and, in so doing, not only found myself in direct competition with Chinese and Japanese raw ores and finished products, but also found, on investigating the market, that the stringent specifications adhered to by antimony-ore purchasers in the United States made it difficult to obtain ores sufficiently "pure" to meet their requirements and leave a profit for the miner. These specifications called for stibnite carrying 40% Sb or over and not exceeding 2% combined "impurities." Inasmuch as "impurities," as defined by the ore purchasers, comprised arsenic, copper, lead, zinc, manganese, bismuth and in some cases iron, I found myself confronted with a hard problem.

With a view to marketing the product in competition with foreign producers, I cast about for a practical method of reducing on the ground my somewhat impure ore, which carried in addition to 3% arsenic, various percentages of nearly all the impurities specified. I exhausted the literature of all the authorities on the subject, from Agricola to Dr. Wang, in investigating pyrometallurgical methods, only to find that producing a reasonably pure product, such as could be called "star" antimony, from impure ores was out of the question by any of these methods. At the same time I balked at the usual volatilization or residual losses, amounting usually to from 20 to 25%, which accompany the employment of the old fire methods.

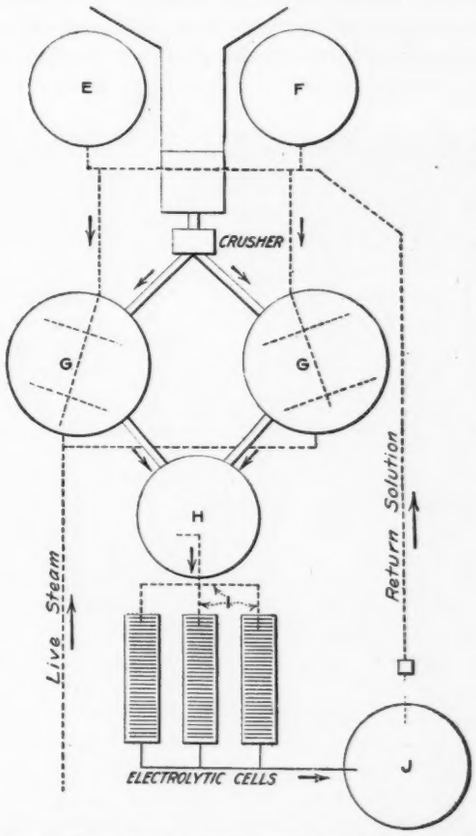
Troubles Solved by Electrolytic Precipitation

Water concentration was tried but did not give satisfactory results, and I was but little better off with the antimony concentrates than with the original ore. Hydrometallurgy was next turned to but while several efficient solvents were found, I could not discover a precipitant that would give a precipitate that could be readily converted into "star antimony," although many precipitates would have made beautiful pigments.

I finally turned to electrolytic precipitation for a solution of the difficulty and the results of the research recompensed me for the time and effort expended. Electrolytic antimony had been produced on an experimental scale in laboratories in Germany, Sweden and other countries, but no well defined process that approached anything that could be commercialized had been evolved. On undertaking to develop such a process I was confronted by many apparently incompatible results.

I found a dependable solvent that would dissolve the antimony without placing in solution other elements and that would also be precipitated at the current density necessary later to throw down the antimony. This was a 7% solution of sodium hydrate to which was added 4% of sodium sulphide. The sodium sulphide was later eliminated as unnecessary.

This solution fulfilled all requirements. Its efficiency may readily be tested by dissolving three grams of stibnite, crushed to pass through an eight-mesh screen, in a beaker with 10 c.c. of the sodium-hydrate solution at 60° C. Complete dissolution will occur in 17 to 20 min. Antimony may be precipitated from this solution with sodium carbonate. This precipitate, however, had no commercial value. So it still remained to find a method of precipitating the antimony in a commercial form or in one that could be made commercial by remelting and casting.



FLOW SHEET OF ELECTROLYTIC ANTIMONY PLANT

E, water-storage tank; F, solution-storage tank; G, leaching tank; H, pregnant-solution tank; I, distributers to cells; J, precipitated-solution sump

On this subject absolutely no reliable data, aside from Faraday's law, could be found. Consequently the

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work was begun with that law. I will not recount here the long series of experiments made in the laboratories of various universities in an effort to determine the proper current-density and voltage, the effect of voltage on precipitate, the proper materials for electrodes, the most advantageous distance between electrodes, and the velocity at which the electrolyte should pass the electrodes, and other important details. I will describe the process of a small plant capable of producing 1000 lb. of electrolytic antimony daily, which with proper manipulation will be chemically pure even when made from so-called impure ores; in such a plant the working tests, on which this article is based, were carried out.

The stibnite ore was crushed to eight-mesh with a No. 2 Limepulver, made by the Jeffrey Manufacturing Co., of Columbus, Ohio, the speed being reduced to 1300 r.p.m. and the grizzlies set with ¼-in. spacings. The hammers were found to be too soft but, had they been made of a good grade of manganese steel, the machine would have been satisfactory and economical for this purpose. As it was, it was necessary to replace the hammers every 24 hours. The crushing was done in the solvent solution. From the pulverizer's discharge the pulp was led away

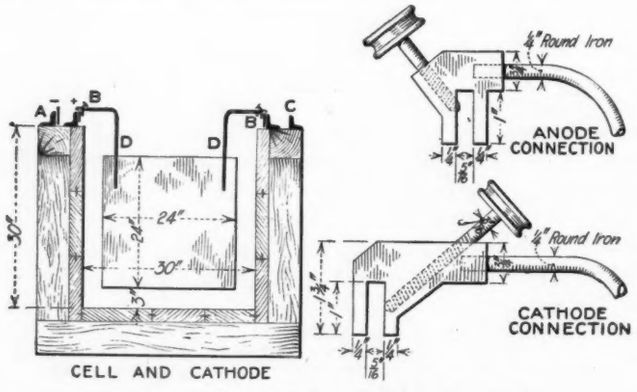


DIAGRAM SHOWING DETAILS OF CELL

A, anode busbar; B, cathode busbar; C, anode dummy bar. Anode connections reach over positive busbars to negative busbar and dummy bar

by a launder to two leaching tanks 16 ft. in diameter with 5-ft. staves and an ordinary type-A filter bottom of Douglas fir, furnished by the National Tank and Pipe Co. of Portland, Ore. The filter bottom was covered with one thickness of cocoa matting, on top of which was spread a seamless woolen filter cloth. The entire leaching side of the plant was, in short, the counterpart of the old type McArthur-Forest cyanide plant; any cyanide or lixiviation plant may be readily converted into a plant for the production of electrolytic antimony.

Live Steam Used in Leaching

When the leaching tank was filled, freshly standardized sodium-hydrate solution was let in through the solution pipes from beneath the filter bottom and allowed to flow upward through the pulp and to overflow through launders, as pregnant solution, into the pregnant-solution tank. Live steam was also introduced beneath the filter bottom in order to maintain a working temperature of 60° C. From the pregnant-solution tank the solution was led, by means of decantation pipes, to the precipitating cells. These were three cells consisting of boxes of 2-in. Douglas fir, measuring 30 in. x 30 in. x 15 ft. inside, having 3 x 3 in. strips, bordering the sides at the top, on which were carried the busbars.

There were three busbars to each cell, the two positive ones being of ¼ x 2-in. copper and the negative one of ¼ x 4-in. copper. A ¼ x 4-in. iron dummy bar, carrying no current, served as support for one side of the anodes, the other side resting on, and taking current from, the negative busbar. The cathodes rested on the positive busbars. The latter were not insulated and were bolted to 1½ x 1½-in. angle irons running along the 3 x 3-in. wooden strips edging the sides of the cell.

Electrodes Made of Mild Sheet Steel

Each cell contained 80 electrodes, consisting of pieces of ordinary mild sheet steel, ⅛ in. thick and 2 ft. square. While the sheet-steel anodes gave satisfactory results, carbon ones would have been better but could not be obtained without considerable delay. Iron would have been better than steel for the cathodes but likewise could not be secured. The electrodes were placed 2 in. apart and the conductivity of the electrolyte was increased by the addition of 2% sodium chloride.

The electric current was supplied by a 5000-amp. variable-voltage direct-current generator, specially built by the Pan-Electric Manufacturing Co. of St. Louis, and was wired to operate between two and four volts. The most successful precipitation was accomplished under a pressure of 2.25 to 2.50 volts. Much of the success was due to the delicacy of control of voltage possible in this generator. A current density ranging from 8 to 9 amp. per sq.ft. of cathode surface was employed. This gave a coarse, crystalline precipitate, easily removable from the cathode by means of a scraper similar to a broad putty knife. The precipitate was allowed to accumulate on the cathodes until a thickness of about ¾ in. had been deposited on both sides, when they were lifted from the busbars and the precipitate scraped off, washed, dried and cast into the usual "star" antimony cake. Its analysis showed 99.94% of antimony.

Low-Grade Antimony Can Be "Starred" in Casting

Considerable practice was required in casting the cake in order to produce the "star" on its upper surface. Antimony buyers usually pay more attention to this "star" than to the actual analysis of the metal, not knowing that it is possible to star even a low-grade antimony product. To succeed in this, the iron or brass molds employed must be warm and covered on the inside either with melted rosin or thin slag. The cast must be made under a cover of melted rosin or thin slag, for the cake will not "star" if exposed to the air while molten. The solutions from time to time are cleared of the accumulated sulphur with carbon dioxide, the sump holding the precipitated solution being covered. Sodium hydrate, sodium sulphide and sulphur may be obtained from the precipitated solution as byproducts.

The cost of producing a pound of star antimony in the manner described above was 2.2c., electricity being generated by means of steam with 13,000 B.t.u. coal costing $2.50 per ton. There is a great deal of antimony in the United States, most of which is in low-grade or complex ores such as the process herein described is adapted to treat. If the owners of such properties would turn their attention to the production, on the ground, of alloys such as anti-friction, type and Britannia metals and selling them to the consumer direct, instead of trying to fight the open markets on "star antimony," they would find it, in general, more profitable.

The New Elm Orlu Hoist at Butte, Mont.*

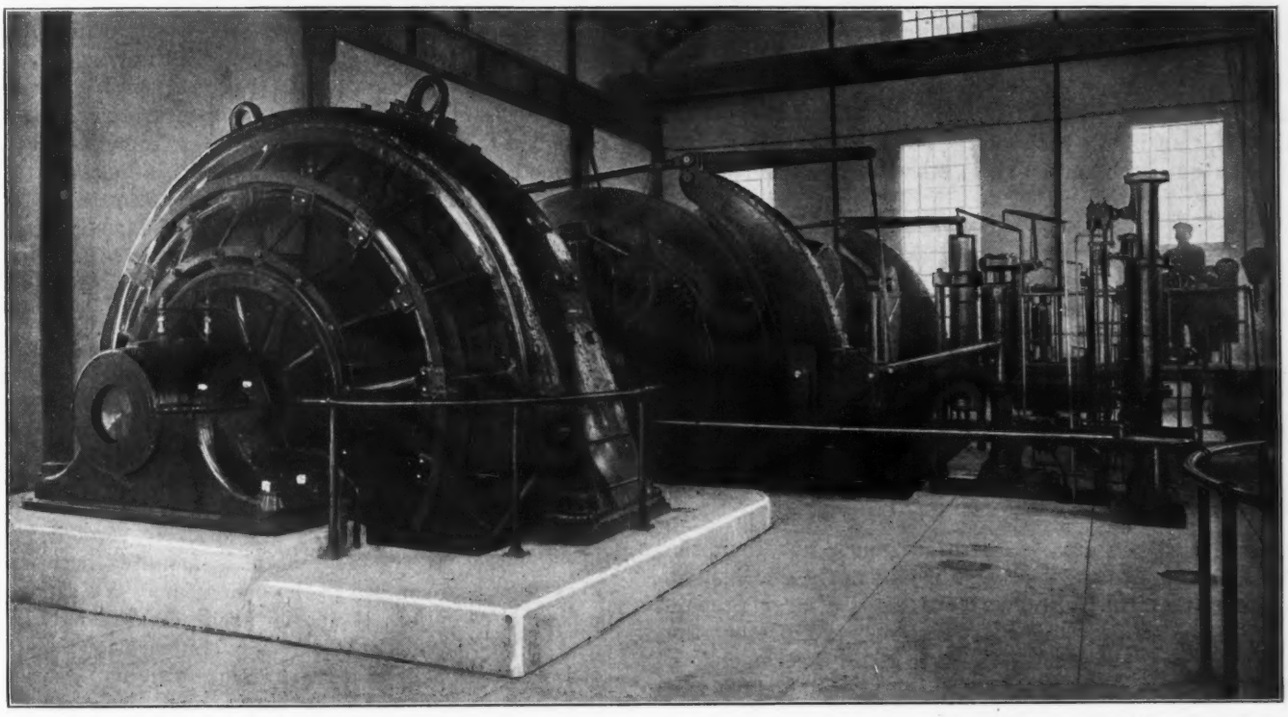
Description of a recent Ilgner-Ward Leonard hoist installation at the Elm Orlu Mining Co., Butte, Mont. This installation is one of the two largest of this type in operation in this country. Data on three sets of tests; the first conducted ta analyze a typical day's run, the second to deter mine efficiency while hoisting under known conditions, the third supplementary to the second test when hoisting from the 1500-ft. level.

DURING the last year and a half, a period to be remembered for its tremendous industrial activity, extraordinary progress was made in the field of mine electrification; and in particular in the electrification of mine hoists of more than average capacity and importance, and for the operation of which the highest type of electrical system was demanded. This progress extended to both the coal-mining and the metal-mining fields. Illustrative of the extent of this progress, it may be said that the number of Ward Leonard and Ilgner-Ward Leonard hoist equipments which will have been put into operation in this country during the two years of 1916 and 1917 will equal the total number operating prior to 1916, and the aggregate horsepower capacity will be 50% greater.

A recent Ilgner-Ward Leonard hoist installation of considerable interest is that at the mine of the Elm Orlu Mining Co. at Butte, Mont. This equipment has been in regular productive operation since February, having been put into commission to replace an old steam hoist. This type of hoist but recently made its appearance in the Butte district, and the present installations are but forerunners of many electrifications which will undoubtedly be made in the near future.

This equipment is of interest (1) because of its capacity, being one of the two largest of this type in operation in this country, and (2) because of its unusual smoothness of operation, simplicity and ease of control, being so noted throughout the Butte camp. The hoisting equipment is installed in a substantial brick building of one room, the motor-generator set with flywheel, the slip regulator and the switchboard occupying all of one end. A view of the hoist and motor is shown in the illustration. The building is exceptionally well lighted, both by day and by night, and there is a particular absence of congestion. Two 20-ton hand-operated traveling cranes provide adequate capacity for the handling of the heaviest parts.

For the driving of large, high-speed hoists, considerations of accuracy of control and safety of operation suggest the use of equipments operating on the Ward Leonard system. This system, combined with a flywheel for load equalization, commonly known as the Ilgner-Ward Leonard system, is utilized where conditions of power supply make flywheel equalization imperative, as in this instance, the reservation charge being based on the maximum instantaneous demand. For this reason, flywheel capacity was supplied sufficient to equalize completely the maximum duty cycle met in balanced hoisting from the deepest level. The shaft has been sunk to a depth of 1800 ft. and ore is being hoisted regularly from the 1100, 1200, 1300, 1400, 1500 and 1800 levels. Ultimately, the ore will be taken from 3500-ft. depth in the Elm Orlu mine.



VIEW OF THE ELECTRIC HOIST AT ELM ORLU MINE, BUTTE, MONT.

*Excerpt from a paper presented by R. S. Sage before the American Institute of Electrical Engineers, June 28, 1917.

The general characteristics of the hoist are as shown in Table I. It is impossible to predict exactly the actual operating schedule in this class of service, but to insure continuity of service, the most important consideration in installations of this kind, the first requisite is that the driving machinery have a safe margin of capacity. A heating guarantee of 40° C. rise for all parts of the electrical equipment was therefore made, for continuous operation, when hoisting the specified hourly tonnage

TABLE I. GENERAL CHARACTERISTICS OF HOIST

Inclination of shaft with horizontal	90 deg.
Present maximum lift	1,800 ft.
Ultimate maximum lift	3,500 ft.
Weight of skip and man cage	11,000 lb.
Weight of ore per trip	10,000 lb.
Weight of one rope (3,500 ft.)	12,500 lb.
Maximum speed of skip per minute during hoisting	2,500 ft.
Diameter of cable	1.5 in.
Weight of cable, per foot	3.55 lb.
Diameter of cylindrical, double-clutched drums	10 ft.
WR^2 of drums	3,600,000 lb.-ft.^{2}
Maximum hourly tonnage (2,000 lb.) from 3,500-ft. level	155 tons
Assumed mechanical efficiency	85%

from any level. The estimated limits of demand from the power supply for the various levels were as follows: From 1500-ft. level, 650 kw.; 2400-ft. level, 760 kw.; 3500-ft. level, 865 kw. The estimated overall efficiencies corresponding to the maximum hourly tonnages are: From 1500-ft. level, 46.2%; 2400-ft. level, 48.3%; 3500-ft. level, 47.7%. The hoist is also used for practically all of the hoisting of an unproductive character, such as handling waste, men, timbers and supplies, and the hoisting of ore is done simultaneously with this sort of work. The over-all efficiency at which the ore is hoisted, that is, the ratio of the net work done in lifting a day's output of ore, to the kilowatt-hours of electric

TABLE II. POWER DEMANDS AND TONNAGES FOR DIFFERENT HOSTING DEPTHS

	1,500-Ft. Level	2,400-Ft. Level	3,500-Ft. Level
When Hoisting 100% Maximum Hourly Tonnage:			
Hourly tonnage	267.00	202.00	155.00
Kw.-hr. per ton	2.46	3.74	5.54
When Hoisting 75% of Maximum Hourly Tonnage:			
Hourly tonnage	200.00	152.00	116.00
Kw.-hr. per ton	2.58	3.89	5.75
When Hoisting 50% of Maximum Hourly Tonnage:			
Hourly tonnage	133.00	101.00	77.5
Kw.-hr. per ton	2.83	4.23	6.17
When Hoisting 50% of Maximum Hourly Tonnage:			
Hourly tonnage	67.00	50.5	38.7
Kw.-hr. per ton	3.57	5.07	7.45

energy used per day, is therefore much less than the figures given above. The mine is still in the devolpment stage so that the unproductive work is a large proportion of the total required of the hoist. At present the slip regulator is adjusted so as to limit the demand to 400 kw., as this is sufficient for the present depths and the present manner of hoisting.

Structural Features of Hoist and Motor

The hoist consists of two steel-plate drums 10 ft. in diameter, grooved to hold 1900 ft. of 1.5 in. steel cable per layer. The drums are mounted between three bearings, on a single shaft which has an extreme length of 40 ft. Each drum is provided with an axial-plate-type clutch and a parallel-motion post brake. The diameter of the brake tread is 14 ft. The post brakes are made of structural shapes and steel plate to form a box girder. The brakes are released and the clutches operated by means of oil through cylinders with floating-level control, served by an oil accumulator in connection with a motor-driven triplex oil pump. A 2-hp. motor supplies all the power required for the brake and clutch engines. The weights by which the brakes are set are in the form of cylinders moving vertically in guides formed by part of the brake engine. In addition to the regulation dial-type depth indicators, the drum flanges are extended to provide a surface for spotting marks. The bearings are all of the two-part type provided with gravity-feed lubrication, in addition to oil rings. Sight-feed oil gages are provided for all the bearings.

To the drum shaft is coupled an 1800-hp., 80-r.p.m., 525-volt direct-current motor which is supplied with two bearings, and sole plates. The armature shaft is 14 in. in diameter in the bearings by 11 ft. 5 in. long, and has a forged half-coupling for connection to a corresponding half-coupling on the drum shaft. The armature is 9.5 ft. in diameter, while the outside diameter of the magnet frame is 14 ft. 5 in. The motor has 16 main field poles, the coils being wound for 125-volt excitation, and has commutating poles to insure good commutation at the heavy overloads encountered in the service. The bearings, in addition to being ring-oiled, receive lubrication from the gravity-feed oiling system. The extreme length of the hoist, with motor, is 51 ft. 9 in. The motor receives its power through a set, consisting of a generator driven by an induction motor, and a direct-coupled flywheel and exciter. The generator has a continuous capacity of 1300 kw., at 525 volts, and in order to commutate successfully the heavy currents at the low voltages, it is equipped with commutating poles, and, in addition, a compensating winding is placed in the pole faces of each of the 12 main poles. As in the case of the hoist motor, the main-field excitation is at 125 volts. The induction motor is rated 1150 hp., three phase, 60 cycles, 2200 volts, and has a synchronous speed of 514 r.p.m. It is of the wound-rotor type, with collectors for connection to the automatic slip regulator.

Flywheel, Constructed of Steel Plates, Weighs 46 Tons and Is Inclosed in Housing

The flywheel is built up of rolled-steel plates, 11 ft. 10 in. in diameter, so that the peripheral speed at synchronism is 19,100 ft. per min. The width of face is 20.5 in., making the total weight 92,000 lb. exclusive of shaft. The plates are securely riveted together by steel rivets. The wheel is mounted between two bearings, and coupled to the generator by a Francke type flexible coupling. A special grade of hard babbitt is used in the supporting bearings. Lubrication is afforded both by means of a low-pressure oil pump geared to the shaft supplemented by ring oiling. The geared pump begins to supply the bearings with oil practically as soon as the wheel turns over. The oil reservoir is sunk below the floor line at the end of the flywheel bearing, and contains coils for the circulation of cooling water.

In order to reduce the demand on the power system, when starting the set, a small motor-driven, high-pressure oil pump is provided to supply oil pressure under the bearings, this pump being put into operation only when required for this purpose. With this starting pump in operation, the set and wheel started from rest with 80% of full-load current from the power system. A close-fitting steel plate cover is provided for the wheel above the floor line, the pit in the foundation virtually forming the lower portion of the enclosing casing.

The exciter armature is mounted on an extension of the induction-motor shaft, the field frame being bolted to an extension of the base. The exciter has a continuous rating of 21 kw., at 125 volts. A cast-iron base is provided under the induction motor and generator, and sole plates under the flywheel bearings. The foundation under the various units is of reinforced concrete extending down to the bedrock, insuring stability of alignment.

Electric-Control System

The hoist-motor speed and direction of rotation are controlled by varying the strength and reversing the polarity of the generator field. The field rheostat is provided with a large number of points giving a corresponding large number of speeds in both directions. Between the motor and generator there is inserted an overload circuit breaker and a single-pole line switch. In the design and installation of the entire equipment, careful consideration was given to the matter of safety of operation, with the result that the effects due to carelessness on the part of the operators are obviated and protection to the men and apparatus is provided in almost every emergency.

The arrangement of the control levers is extremely simple, there being but one power lever, a forward movement corresponding to one direction of rotation and a backward movement, the reverse. This lever with the two brake levers, one on either side, completes the lever group. The clutches are operated by a throw, either in or out, of a crank through an arc of 180°. A center-zero direct-current ammeter and voltmeter are mounted in the line of vision with the depth indicators.

TABLE III. RESULTS OF TEST FOR A TYPICAL DAY'S RUN

Duration of test	12	hours
Actual time hoist in motion	3.5	hours
Total number of trips made	280	
Number of skips of ore hoisted	63	
Percentage ore trips of total	22.5%	
Total weight of ore hoisted	252.5	tons
Average weight of ore per skip	4.01	tons
Average lift of ore	1,428	ft.
Net work done on ore—total	272	kw.-hr.
Net work done on ore—per trip	4.32	kw.-hr.
Net work done on ore—per ton	1.08	kw.-hr.
Kw.-hr. energy used during day	1,500	kw.-hr.
Total kw.-hr. energy used, including nonproductive work per ton ore hoisted	5.94	kw.-hr.
Kw.-hr. used while hoist at rest	680	kw.-hr.
Kw.-hr. used while hoisting ore	582	kw.-hr.
Kw.-hr. returned to power system	14.6	kw.-hr.
Over-all efficiency while hoisting ore	46.7%	

The trips with ore were divided among the levels as follows:

Level	No. Trips	Actual Lift
1,000 ft.	6	1,068.5 ft.
1,100 ft.	3	1,170.0 ft.
1,200 ft.	3	1,271.2 ft.
1,300 ft.	20	1,372.5 ft.
1,400 ft.	7	1,473.5 ft.
1,500 ft.	22	1,574.5 ft.
1,800 ft.	2	1,915.2 ft.

The weight of ore hoisted was obtained by observing the number of cars dumped into each skip and using an average weight per car obtained from a large number of cars.

A Welch safety device compels slowing down at the proper rate and provides protection against overwinding and overspeeding. As an additional protection, limit switches actuated by the skips themselves are installed in the guides. These switches, as well as the Welch device, cause the direct-current circuit breaker to open, in addition to setting the hoist brakes. In general, any emergency which will cause the direct-current circuit breaker to open will cause the brakes to be applied. The direct-current circuit breaker will open under any of the following emergencies: Extreme direct-current overload, overwind top or bottom, loss of exciter voltage, loss of motor-field excitation, overspeed of hoist, or overspeed of motor-generator set.

The opening of the main line alternating-current, oil circuit breaker will not open the direct-current circuit breaker, nor set the hoist brakes, but the operator is free to continue hoisting as long as the stored energy in the flywheel will permit. The opening of the line switch is indicated in the usual manner by the ringing of a bell. When the direct-current circuit breaker has been opened under any of the above-mentioned emergencies, and an application of the brakes made, the brakes cannot be released until the controller lever has first been returned to the central position. After an over-wind has occured, it is necessary for the hoist operator to throw a small switch before power can again be applied to the motor and motion is possible only in the lowering direction.

Energy Stored in Flywheel

The total energy in the flywheel at 94% synchronous speed is 117,000 hp.-sec., of which approximately 50% is available for operating the hoist in the event the set was disconnected from the power supply, the limitation being the speed at which the direct-current exciter is no longer able to hold up its voltage. If required, a complete trip with a fully loaded skip could be made from a depth of 1500 ft. on the energy of the flywheel, and a load of men could be hoisted from the deepest level. Hoisting "out of balance" can be carried on without causing excessive speed reduction of the set or necessitating a higher limit of demand from the power supply.

The liquid slip regulator used with this equipment is worthy of special mention, as being a decided departure in important details from the heretofore generally accepted design. In the latter, it was necessary to make a water-tight joint between the tile or porcelain vessels and the cooling tank, and also between the tile and the electrodes, clamping rings or draw bolts being used for this purpose. In many instances, this construction in connection with temperature changes resulted in broken tiles, causing much annoyance. In the present design the tiles are simply placed upon a rubber mat on the steel bottom of the tank, the only water-tight joint being that between the lower electrodes and the bottom of the tank. Only enough pressure is applied on the tile by the holding-down bolts to hold it in place, the purpose of the tiles being merely to serve as barriers to prevent leakage between phases. Common sewer tiles are used for the purpose. The value of the input limit is adjusted in the usual manner by varying the number of the counterbalancing weights.

The first set of tests was for the purpose of analyzing a typical day's run under ordinary conditions, as regards its relation to the electrical equipment. In the second tests, measurements were made of the electrical quantities for a few trips to determine, if possible, the efficiency while hoisting under known conditions. The third test was supplementary to the second.

Efficiency Test Under Daily Hoisting Conditions

A log was kept of all the movements of the hoist from 7 a.m. to 7 p.m., recording the time, the nature of all trips, quantity of ore, etc. The only instruments in use were the alternating-current recording wattmeter—30-in. feed per hour—Karlic tachograph and integrating

polyphase watt-hour meter. As mentioned in the preceding paragraphs, there are no special, designated periods of the day during which the hoist is used exclusively for the hoisting of ore, but this is carried on simultaneously with the unproductive work, as the conveying of timber, men and supplies. Moreover, the hoisting is of such an intermittent nature that a straight-line input to the motor-generator set is not even approximated, even at the low limit of 400 kw. Storage or bins are under construction, but were not in operation at the time of the tests. The results of the first test are shown in Table III.

The calculated net work done in lifting the ore is subject to some error, inasmuch as during about 25% of the trips timber or men were lowered in counterbalance with the ore. On the other hand, men were hoisted with the ore during about 20% of the trips. During about 50% of the trips with ore, at least one stop was made between the loading level and the dump, there being a maximum number of six such stops. The total kilowatt-hours used was obtained from readings taken on the watt-hour meter at the beginning and end of the test. The energy used during the ore trips was obtained from the record made by the 30-in.-per-hour, curve-drawing wattmeter with the aid of a rolling planimeter. The energy returned to the system was obtained in the same manner. The time during which the hoist stood at rest was taken from the tachograph record.

Efficiency Test Under Rapid Hoisting Conditions

In order to secure as rapid hoisting as possible, there was accumulated at the 1500-ft. level, 30 cars of ore making possible five consecutive trips, as fast as the skips could be loaded. Continuous records were made on the graphic meters of the direct-current voltage and current and of the alternating-current current. A time marker marked every second on all the records, simultaneously. The speed of the motor-generator set was read at frequent intervals and telegraphed to one of the graphic records at the instant of reading, a record of the consecutive readings being kept which was later transferred to the graphic record. The speed of the hoist motor was taken from the tachograph record and the 30-in.-per-hour recording wattmeter supplied a record of the power delivered to the motor-generator set. Conditions of the second test are shown in Table IV.

TABLE IV. TESTS FOR EFFICIENCY UNDER RAPID HOISTING CONDITIONS

(Hoisting Done in Balance)

Duration of test	565	sec.
Lift	1,574.5	ft.
Number of skips hoisted	5	
Weight of ore hoisted	20.3	tons
Average weight per skip	4.06	tons
Net work done—total	24.1	kw.-hr.
Average time per trip	113	sec.
Actual running time—total	310	sec.
Actual running time—average per trip	62	sec.
Time at rest—total	255	sec.
Time at rest—average per trip	51	sec.
Average time for acceleration	22	sec.
Average time for running at full speed	15.5	sec.
Average time for retardation	24.5	sec.
Average rope speed	1,525	ft. per min.
Maximum rope speed	2,580	ft. per min.
Average speed of M-G. set	486	r.p.m.
Hoist motor input (exclusive shunt field)	32.64	kw.-hr.
Hoist motor output	28.2	kw.-hr.
Mechanical efficiency of hoist	83%	
Energy input to M-G. set total	50.5	kw.-hr.
Kw.-hr. per ton	2.49	
Over-all efficiency	47.7%	

The energy dissipated in the various parts of the equipment was found to be as given in Table V.

The hoist-motor input was measured directly, and the output was obtained by deducting the losses which were based on factory-test results. The power input to the motor-generator set when running light as measured by the 30-in.-per-hour, curve-drawing wattmeter, and checked by the indicating wattmeter was 80 kw. at 512 r.p.m. For the average speed of the set during the test this was taken at 78 kilowatts.

The segregation of the losses in the set was made from results of tests made in the factory. The running-light input to the set includes bearing, friction and windage for flywheel, generator and induction-motor; induction-motor core loss and running-light copper loss; hoist-motor shunt field (with economy resistance in series); exciter loss with load of motor field. The same

TABLE V. ENERGY DISSIPATED IN MECHANICAL PARTS

	Kw.-Hr.	Per Cent. of Net Work.
Losses in mechanical parts of hoist, sheaves, guides, etc	4.1	17.0
Hoist-motor losses	6.25	25.9
Generator losses	5.53	22.9
Induction-motor losses	3.99	16.6
Flywheel losses	4.08	17.0
Slip-regulator losses	2.12	8.8
Exciter losses	0.39	1.6
Total losses	26.46	109.8
Net work done on ore	24.1	
Total energy consumed	50.56 kw.-hr.	
Overall efficiency	47.66%	

total loss in the equipment is obtained by adding to the running-light loss of the set, the increase in losses while under load, these being readily calculated. On this basis, the result is as shown in Table VI. An item not included in this segregation, consisting of approximately 0.25 kw.-hr., used in operating the accumulator oil pump and the brake solenoids, is also included in the running-light input. The total energy accounted for is therefore 50.81 kw.-hr., as against 50.5 shown by the wattmeter.

TABLE VI. RUNNING-LIGHT INPUT

	Kw.-Hr.
Motor shunt field (increase)	0.248
Indicator motor copper loss (increase)	0.223
Exciter loss (increase)	0.060
Generator losses (excluding friction and windage)	3.019
Motor losses (excluding shunt field)	4.440
Regulator losses	2.120
Running-light loss of set	12.250
Friction in mechanical parts of hoist	4.1
Total	26.460

The energy output of the generator, as obtained from the direct-current power curves by the aid of a rolling planimeter was 32.64 kw.-hr., and the input 38.17 kw.-hr. The input to the generator was at the rate of 243 kw., so that during the trips, approximately 27.5 kw.-hr. were required from the flywheel. The average speed reduction of the set during hoisting was 10.6% on the basis of which, the energy given up during the five cycles was 96,500 kw.-sec. or 26.8 kw.-hr., which checks fairly well with the figure given above.

In general, the test results check well with the estimated performance. The friction losses in the hoist, sheaves, rope and guides proved unexpectedly low, but the shaft guides are in good repair, and the cage rides almost as smoothly as a passenger elevator. Also, the hoist drums run true and with no interference with the brake-shoe blocks; the head sheaves and idlers are well lubricated and easy-running.

The efficiency of hoisting exceeded that anticipated, even with the light loads, the load per skip being but 80% of that considered normal. With heavier loads, as when hoisting high-grade copper ore, the efficiency would be further increased. Hoisting was done at slightly less than 50% of the maximum rate for this level and the power consumption was 2.49 kw.-hr. per ton as com-

pared with 2.83 kw.-hr., expected. The tendency should be for the efficiency to increase at the greater depths, the maximum probably being reached at the intermediate levels.

The time for retardation is considerably longer than that used in calculating the duty cycles, and is the result of the rather close setting of the Welch safety device. At present there is no particular reason for rapid hoisting, and the management, being inclined to a policy of safety, requires the slower rate of retardation. A reduction in the retardation period would further tend to a betterment of the efficiency of hoisting. The standby losses are considered particularly low for an equipment of this capacity.

It is believed that by decreasing the loading time so as to obtain a more uniform input to the power set, decreasing the retardation period and bringing the load up to normal, the hoisting efficiency of this outfit will reach 50% at this level. It is believed that the results of these tests give fairly accurate information as to the operating characteristic of the hoist at the Elm Orlu and indicate, in general, the results to be expected of the performance of other Ilgner equipments in similar service.

Supplementary tests of the same nature as those referred to as second test were made when hoisting from the ore pockets subsequently completed at the 1500-ft. level. During this test 12 skips were hoisted from the pockets, the time of loading averaged 27.3 sec., as against 51 sec. during the previous test. The higher overall efficiency obtained, namely 50.2%, is due to the decreased standby loss as a result of the decreased loading time. It will be noted that the total lift was increased 43.5 ft. when hoisting from the pockets, thereby increasing slightly the work done per trip. Table VII shows the conditions pertaining to this test and the results observed therefrom.

TABLE VII. SUPPLEMENTARY TESTS FOR EFFICIENCY

Duration of test	1,081 sec.
Lift	1,618 ft.
Number of skips hoisted	12
Weight of ore hoisted	97,400 lb.
Average weight per skip	4.06 tons
Net work done—total	59.38 kw.-hr.
Average time per trip	90 sec.
Actual running time—total	754 sec.
Actual running time—average per trip	62.8 sec.
Time at rest—total	327 sec.
Time at rest—average per trip	27.3 sec.
Average time for acceleration	21.8 sec.
Average time running at full speed	17.0 sec.
Average time for retardation	24.1 sec.
Average rope speed	1,545 ft. per min.
Maximum rope speed	2,550 ft. per min.
Average speed of M-G set	481 r.p.m.
Hoist-motor output	70.7 kw.-hr.
Hoist-motor input (exclusive shunt field)	81.5 kw.-hr.
Mechanical efficiency of hoist	81%
Energy input to M-G set—total	118 kw.-hr.
Kw.-hr. per ton hoisted	2.425
Overall-efficiency	50.3%

Mine Lien Claims

BY A. L. H. STREET*

As noted by the Oregon supreme court in the late case of Bishop vs. Henry, 165 Pacific Reporter, 237, no valid lien can attach to mining property on account of labor or supplies furnished for its improvement or development, except as such lien may be expressly authorized by statute and except as there may be substantial compliance with such statute in the matter of filing notice, etc. But it is decided that under the Oregon lien law there is no necessity for stating the name of the owner of the mining property against which a lien is asserted, in the statement of lien filed with the county clerk, unless such owner is known to the lien claimant.

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Danger of Oxygen Rescue Apparatus

When oxygen rescue apparatus was first introduced in the United States and made use of in the mines following explosions and fires, there was a wide misconception on the part of many miners and mining men as to the extent to which it might be used, and the limitations of the physical endurance of those who volunteered to wear the apparatus. Many conceive the idea that with an oxygen apparatus a man immediately acquires superhuman strength and endurance. It is not putting it too strongly to state that a number of good men have gone to their death in an effort to satisfy a false belief on the part of spectators that the apparatus had no limitations, and that the wearer knew no limit of physical exertion.

The helmet type of apparatus has received condemnation by many scientific investigators, and the Bureau of Mines has publicly denounced its use for mine or fire-fighting purposes; still there are some who persist in its use, and they are but challenging death. Some helmets may be made to fit tightly temporarily, but the models now in use have large dead spaces, and under enforced breathing admit external air.

It is safe to say that a number of deaths here and in foreign countries have resulted through the wearer breathing his own carbon dioxide, or through leakage of external air into the circulating system of the apparatus. To overcome the re-breathing of air highly charged with carbon dioxide, an efficient absorber is one of the essentials; the apparatus, if of a constant-feed model, should supply an excess of oxygen above the requirements of the wearer; if an intermittent feed, there should be either a constant leakage externally or an auxiliary supply held within a flexible medium under small pressure, which will make the breathing circuit under positive pressure.

The difficulty experienced by designers and manufacturers heretofore has been that the physiological requirements have not been given full consideration. The apparatus has been constructed in a manner which enables the wearer to perform limited physical work. However, it is a source of gratification to report that some manufacturers are now enlarging the absorbers and providing a bypass valve and readjusting the zone of reduced, or negative, pressure.

The Gibbs apparatus, described in U. S. Bureau of Mines technical paper No. 82, is constructed with the sole idea of adapting the apparatus to the limitations of the wearer, whereas some types now in use require the man to adapt his activities to the limitations of the apparatus. This subject has been discussed in a technical paper issued by the Bureau of Mines under the joint authorship of Dr. Yandall Henderson and James W. Paul, the subject of which deals with the status of oxygen-rescue apparatus and the physiological effect on users of such equipment.

*Abstract of an article, "Status of Oxygen Rescue Apparatus and Physiological Effects on Users," by James W. Paul, chief of coal-mining investigations, U. S. Bureau of Mines, Pittsburgh, Penn.; presented at the meeting of the National Safety Council, New York, Sept. 13, 1917.

Eugene Franz Roeber

Dr. E. F. Roeber, editor of *Metallurgical and Chemical Engineering* died at his home in East Orange, N. J., Oct. 17, 1917, after a lingering illness of several months. He had not enjoyed the best of health for a year or more, but it was not until last June that he was compelled to leave his work, to which he never returned. For some time it was hoped that complete relief from care and responsibility, coupled with the best of medical attention, would restore him to health and activity, but he failed steadily and came to an untimely end in the prime of life.

Dr. Roeber was born in Torgau, Saxony, Oct. 7, 1867, and passed his 50th birthday 10 days prior to his death. His excellent education in science and engineering was received at three German universities, Jena, Halle and Berlin. At the last institution he received the degree of doctor of philosophy in 1892. Without waiting to find a field for his abilities in his native

DR. E. F. ROEBER

country, he came to the United States in 1894. For several years he remained in comparative obscurity and for part of that time, at least, was associated with the book concern of E. Steiger & Co. in New York.

In 1899 he made the acquaintance of Dr. Carl Hering, of Philadelphia, who engaged him as an assistant. This was his first professional engagement and marked the beginning of a notable career in electrochemistry, which led to his recognition as a leader. His work evidenced characteristic thoroughness, reliability and conscientiousness. These qualities—which he later applied with marked success as a technical editor—first became apparent in his digest of foreign literature for the *Electrical World.*

The early days in Philadelphia witnessed two important undertakings in which Dr. Roeber played a prominent part. It was then that electrochemistry was assuming an aspect of importance in this country, and the time seemed opportune to publish a journalistic exponent for the industry. Accordingly *Electrochemical Industry* was established as a monthly publication in September, 1902, with Dr. Roeber as editor. It was edited at Philadelphia until June, 1903, when the office was removed to New York. Under his guidance the magazine grew in importance and influence, and in January, 1905, it assumed a broader field of activity under the title *Electrochemical and Metallurgical Industry.* In 1906 came the absorption of the *Iron and Steel Magazine,* and in January, 1910, there was a further expansion of the field served by the magazine to include the general realm indicated by the present title, *Metallurgical and Chemical Engineering.* Through all of these logical developments Dr. Roeber remained as editor, directing the policies and enlarging the field of service of the magazine which stands as a fitting tribute to his ability.

The other project, initiated in Philadelphia about the same time, was the organization of the American Electrochemical Society. This developed from the close association of Dr. Roeber with C. J. Reed, Carl Hering and others, and had its inception in the informal gatherings and discussions of that group. Dr. Roeber's enthusiasm and encouragement in the organization and continued support of the society was responsible in large measure for its success and present influence. It must now be gratifying to its members to know that in 1913-14 they honored Dr. Roeber with the presidency.

He had a wide interest in science and engineering and a broad knowledge of both. This, coupled with an unusual ability to express himself in a pleasing literary style, gave his own writings a tone of authority and confidence, and enabled him to choose wisely from the contributions of others. In speech his English was broken, but in writing it was exact and fluent. This was because he early recognized the demand which the editorial profession made upon him, and he applied himself to it with characteristic thoroughness. His services, therefore, were in demand by publication committees and library boards of several technical societies. He was the author of Section 19, on electrochemistry, of the "Standard Handbook for Electrical Engineers" and was also the author of many technical papers presented before various societies. His personality was attractive, and he made many friends through his quiet affable way of becoming interested in their work. The formality of the introduction was soon forgotten. His wide interest in science and engineering were evidenced by membership in the American Electrochemical Society, American Chemical Society, American Institute of Mining Engineers, American Institute of Electrical Engineers, American Institute of Chemical Engineers and Society of Chemical Industry. He was a member also of the Chemists' Club in New York.

The high personal regard in which he was held by his professional friends was evidenced in many ways, but probably with no more kindly and sincere token than the silver loving cup which was presented to him during his presidency of the American Electrochemical Society. This was an appreciation by a large number of friends throughout the country who gladly responded to a proposal made by Dr. L. H. Baekeland. On May 6, 1900, Dr. Roeber married Miss Clara H. Feier, of New York, the ceremony being performed in Hoboken, N. J. He is survived by his widow and three sons, Edward and Bert, aged 11, and Robert aged four.

Plumbago Crucibles

The manufacture of plumbago crucibles has been seriously affected by conditions due to the present war. The disturbances have extended to the users of crucibles, involving increased costs and in some cases reducing output because of the shortage of crucibles of the proper quality. It is believed by M. McNaughton of the Joseph Dixon Crucible Co. that it would be well for the crucible users to be more fully informed as to the details of manufacture that have been disturbed by war conditions, and an article on the subject was prepared for the *Journal* of the American Institute of Metals, referring to the conditions of supply and demand of the essential materials of crucible making.

The important and essential ingredients of plumbago crucibles are the plumbago and the clay which serves to hold the crucible together during manufacture and in use. The supply of plumbago comes largely from the Island of Ceylon and the stock usually carried is a two to four months' supply, with a similar amount contracted for. Shipments by direct steamer usually require from five to eight weeks. In October, 1914, the British government placed an embargo on plumbago exports from Ceylon, lasting more than four months. This cleaned out the reserve stocks of American manufacturers. After the embargo was raised shipments were generally regular enough to meet requirements, except for short periods.

Before the war all the clay for plumbago crucibles was imported almost exclusively from the town of Klingenberg in the western part of Germany. The clay is remarkably pure and uniform, and the deposit large enough to supply all the demands that have been made upon it. Mining and shipping were conducted throughout the year, shipments reaching the United States in from four to six weeks after leaving the mines. Crucible makers usually carried a year's supply in reserve, to secure the advantage of natural drying and to detect and correct such slight variations as might occur in the quality.

Soon after the war began Germany prohibited the shipment of this clay, no doubt foreseeing the demand of the Allies for ammunition and metals, with the consequent increased demand for crucibles. As this demand soon manifested itself, it was seen that a substitute must be found for the German clay. It was necessary to experiment, and customers were informed of the uncertainty regarding the quality of crucibles made from domestic clays. In trying out different mixtures the plan adopted was to make trial lots of six crucibles from each blend of clay. As it takes from two to three months to make and burn crucibles and get results from tests by users, progress is slow. If the first trial is favorable lots of from 50 to 100 are made and sent out to different users. When the results obtained are in practical agreement, the information is of value. But often this is not the case and the test must be repeated.

One great difficulty has been in getting proper reports as to the running of test lots. Many users did not appreciate the importance of getting the information to the maker in an accurate way. The results of early attempts to use domestic clays were distinctly unsatisfactory. While before the war 25 to 30 heats were secured from each crucible, the first use of domestic clays gave only four or five. At present, however, from 15 up to 20 and 25 heats are obtained for an average-size crucible, such as No. 80, used in standard rolling-mill practice. By a process of elimination the clays now in use are comparatively few, and a steady improvement is expected in the quality of crucibles. However, the cost of the domestic clay is more than double that of the German clay.

Increasing Dividends Through Personnel Work*

Accident prevention, sanitation, "welfare" work and other such activities have attracted attention as if they were distinct fields, but many different phases of the single problem of human engineering are closely related. Unsatisfactory housing conditions are an important cause of labor turnover which, in turn, is one of the most important causes of a high accident rate. Accidents cause loss of time and thus interfere with production. Usually the employer must provide medical aid and pay wage compensation. New men must be hired to replace those incapacitated by accident, thus increasing the accident hazard. If many accidents occur in a plant, fear of injury keeps some men away and reduces the efficiency of others. Prevention of illness should receive attention. In one case that was studied the lost time reported as due to illness was four times as great as that due to accidents.

The cost of hiring a man is not merely that of interviewing him, making a medical examination, placing him on the payroll, sending him to his foreman and getting him assigned to work. Other factors are the difference between the standard amount of work and that which he does while getting used to his job; the extra materials spoiled by a new man; the extra supervision required; interference with the work of others; and, not the least, the accidents caused by green men. The cost of training a green man has been computed at from $25 to $100 under different conditions. Some companies who keep records find that the ratio between the number of men hired and the actual increase in the working force ranges from 4 : 1 to 15 : 1. In most cases to keep a working force at normal strength the number of new men hired during a year will be equal to or even double the number of the force. Therefore costs run higher than under steadier conditions.

The best method of decreasing labor turnover is to have a capable man in charge of an employment department. His duty will be to get men suited for the jobs. Having secured suitable men, the next step is to make conditions such that they will desire to remain. While discipline in a community is all right in its way, people should be allowed to do what they want to do if there is no valid reason against it. The point is made that companies are now selling employment instead of buying labor; that the mental attitude must be adjusted to conditions; that money spent in serving the convenience and comfort of the workmen will return big dividends.

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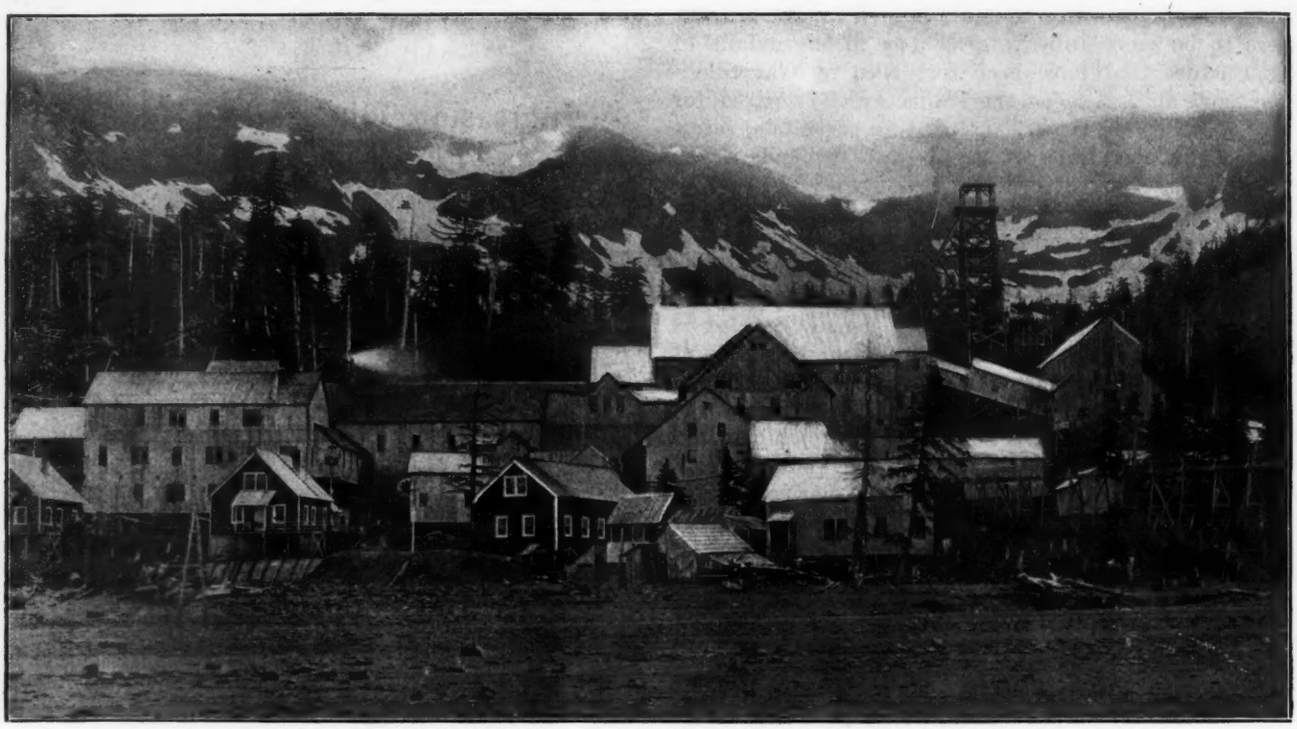
*Abstract of a paper by Thomas T. Read, presented at the St. Louis meeting of the American Institute of Mining Engineers, Oct. 8-13, 1917.

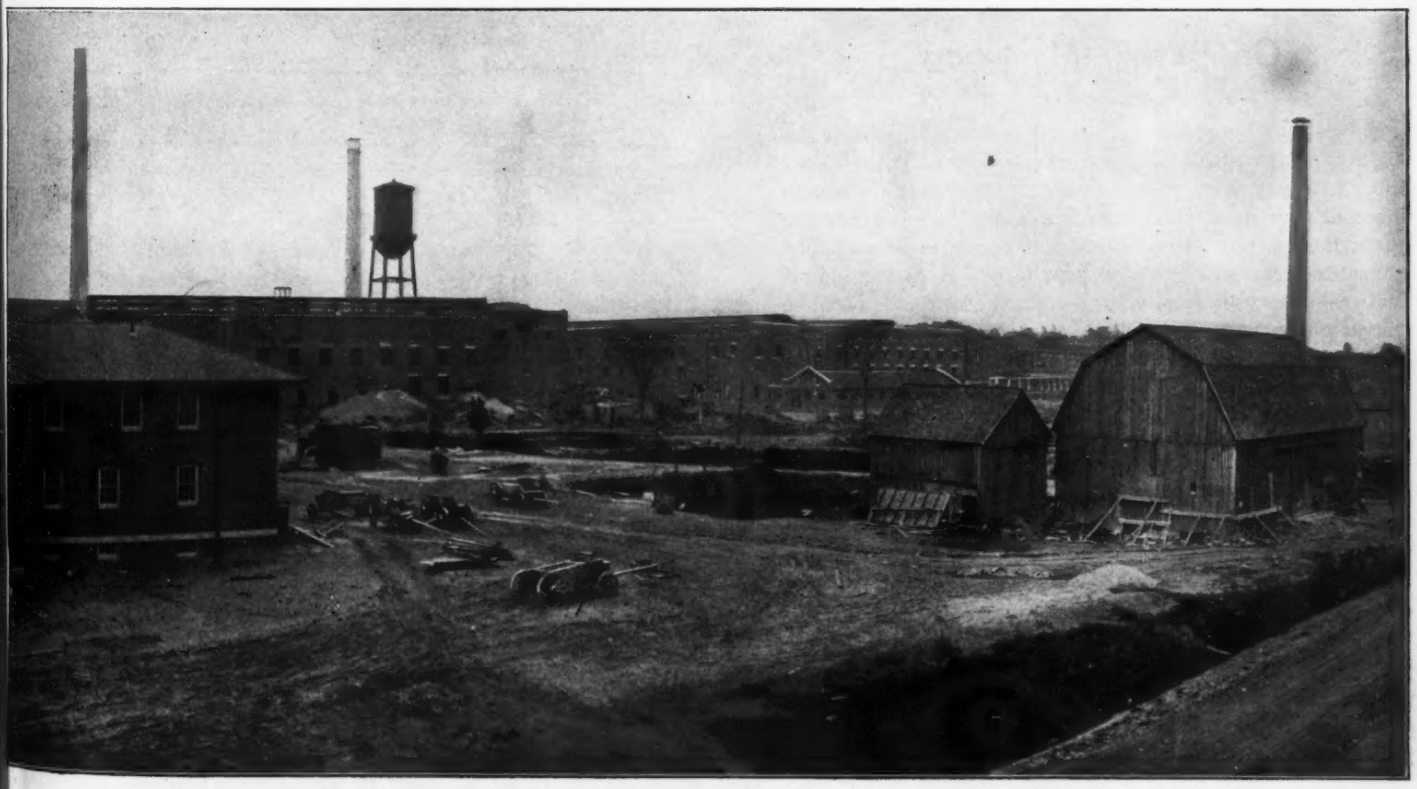
Photographs from the Field



MILL OF THE BEATSON COPPER CO., A KENNECOTT SUBSIDIARY, AT LATOUCHE, ALASKA

THE NEW $5,000,000 REFINERY OF THE INTERNATIONAL NICKEL CO., UNDER

BONANZA MILL OF THE KENNECOTT COPPER CORPORATION AT KENNECOTT, ALASKA

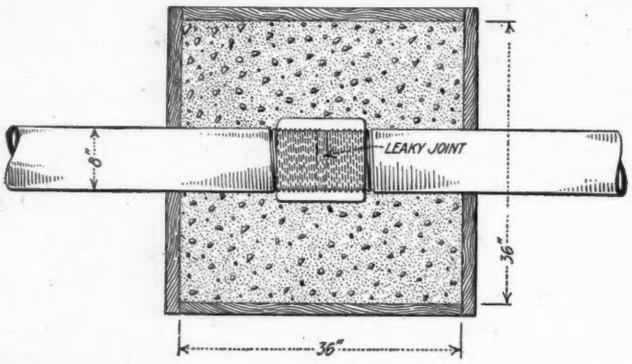


CONSTRUCTION AT PORT COLBORNE, ONT.—PHOTOGRAPH TAKEN SEPT. 29, 1917

Details of Practical Mining

Concreting Leaky Pipe Joints

A joint of screwed pipe of large diameter that could not be successfully tightened caused considerable annoyance and trouble. The installation was such that it could not be relieved of the pressure even for 24 hours to permit a tightening of the joint. To remedy the



SECTION OF FORM FOR CONCRETING PIPE JOINT

leakage, forms were put around the troublesome joint and filled with concrete which was well tamped to prevent air pockets or other voids. After drying, the wooden forms were removed and no further trouble was experienced. The concrete used did not contain any gravel or stones larger than ¼ in. in diameter.

On Buying Machinery*

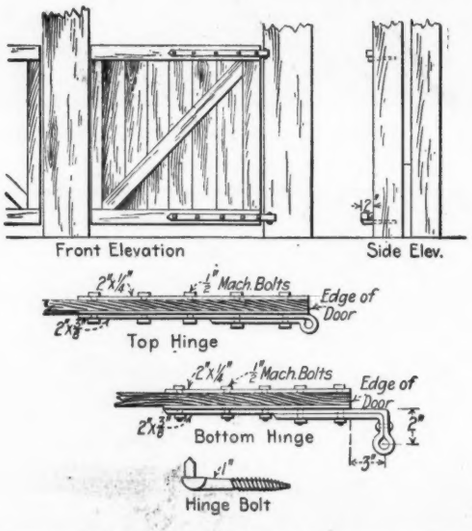
BY W. F. SCHAPHORST†

Sometimes buyers complain about their machines being inefficient after it is too late. They say that they were 'stung.' I know of a case of this kind in which the machine used was guaranteed to render a certain performance, but from the start it failed to do so. The guarantee was good for one year only. Both the manufacture and user were to blame, I contend, because the machine certainly wasn't 'as represented,' and the buyer was too lenient. The manufacturer insisted that after a time, when the machine was properly 'worn in,' it would come up to the prescribed mark. But it never did, and the owner is still waiting. The year has passed and the guarantee is no longer active. The owner can't hold the manufacturer any more. This does not happen often nowadays, because most reliable manufacturers are willing to make good even after several years, guarantee or no guarantee. The point I want to make is that there is seldom any excuse for buying inefficient machinery of any kind, unless one sets out to buy something cheap. One can hardly expect a cheap product to be efficient. Before buying expensive machinery, though, one has several ways of predetermining whether or not that machinery will be efficient.

Manufacturers are generally willing to make tests before the machine leaves the factory, and at these tests the buyer is allowed to have as many representatives as he wishes. After such tests are made to the full satisfaction of experts, there is seldom any chance that the machines will go wrong or fall below guaranteed performance. It often pays to employ competent experts for the selection of machinery. Lastly, if the machine doesn't fulfill the guarantee, don't be afraid to ask the manufacturer to make good. Present-day manufacturers are anxious to make good, because they know that any case of poor or unsatisfactory performance means a 'black eye' for the manufacturer.

Self-Closing Door for Mine Shaft

Kinks that are not always new are sometimes nevertheless good, says H. J. Brown, in *Coal Age*. Some time ago an institute bulletin published pictures of a self-closing shaft gate. They didn't look right, but



THE HINGES AND THE DOOR THEY SUPPORT

gates hung in accordance with the accompanying illustration are square with the world.

While doing some consulting work for a certain company it became necessary to replace the shaft "bars," for reasons of safety, with something that would stay closed. I gave the boss carpenter the necessary instructions, only to be met with a blank stare. They do not use gates much hereabouts.

I had to make sketches. The blacksmith did his part, and the boss carpenter, against his better judgment, hung them—and with them his convictions that they wouldn't work.

The gate hangers here shown are only the old hinges that suported the gates we used to swing on when we were kids, but the gates hang straight and stay shut.

*Copyright by W. F. Schaphorst, 1916.
†Engineer, Woolworth Building, New York.

Mining and Metallurgical Machinery

Machine for Punching Out Bits and Shanks of Hollow Drills

The modern hammer drill, using hollow-drill steel and air or water to expel the cuttings from the drill hole, is employed in practically all rock-drilling operations today. Keeping the hole in the drill steel properly opened is important for the reason that plugged steels wholly or partly prevent proper functioning of the drill, speed of operation is retarded, water tubes are bent or broken, and time is lost in tinkering, or

LEYNER SHANK AND BIT PUNCH

the drilling gang is idle while someone makes a trip to the shop after more steel or water tubes.

To relieve this condition, the Ingersoll-Rand Co. has developed and is placing on the market, as an auxiliary to the Leyner sharpener, a new device—the Leyner shank and bit punch.

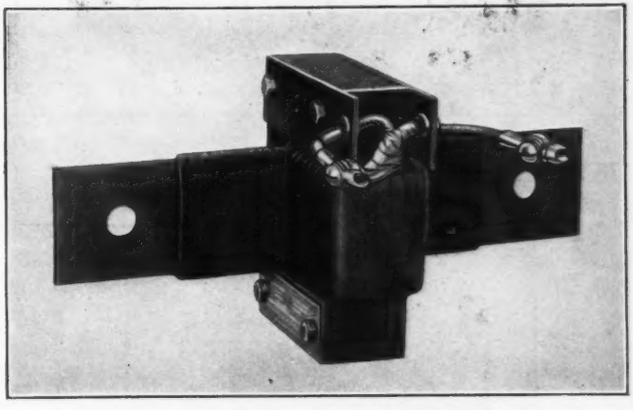
This machine is compact and simple in construction. It consists of a cast-iron pedestal, at the top of which are bolted the clamping and punching cylinders and apparatus. The drill steel is clamped by two jaws brought together by the movement of a pinion, which is operated by the clamping cylinder through the medium of a rack on the extended piston rod. The heat-treated steel punching pin is attached to the piston of a punch-operating cylinder in such a manner that it may be removed readily should occasion require. The front head of the punch cylinder is provided with a clearance space around the punching pin so that on the extreme reverse stroke air is exhausted against the heated pin, effectually cooling it. The maximum stroke of the punch is 6 in. An adjustable stop for the drill steel is provided so as to regulate the distance to which it is desired to have the pin penetrate. The standard punching pin is $\frac{7}{16}$ in. in diameter for a distance of 2 in. from the end and $\frac{3}{8}$ in. for the remainder of its length.

The operation of the machine is controlled by a single lever moving in a T-slot. A downward movement clamps the steel and a further side movement operates the punch. The operation of the control lever locks the clamp jaws before the punch can be brought into action. In like manner the punching device must be in neutral position before the clamp jaws can be opened. This safety feature prevents action of the punch before the steel is firmly clamped and in perfect alignment. All the movable parts of the machine are protected from dirt, grit and damage by tight-fitting covers which also assure safety in operation. The Leyner shank and bit punch occupies a floor space of 22 x 44 in. and weighs 400 lb. Planking is the only foundation required.

Cheaper Electrical Protection

Suppose something—a short-circuit for instance—should take place on the power line, and the machines in the generating station should happen to be unprotected. Serious damage would almost certainly result.

But, of course, this rarely happens, for protection is usually adequate. Circuits are safeguarded automatic-



TRIPPING TRANSFORMER FOR PROTECTING ELECTRICAL CIRCUITS

ally by electrically operated devices which, opening under unusual stress, cut off the circuit at a sign of danger.

As a rule, these automatic devices receive the power which causes them to open the circuit from "current transformers," which change the current from a large to a small quantity and keep the dangerous "voltage" away from the automatic devices. The transformers also assist measuring instruments in their duties as indicators and recorders of the current or power of the line. When thus used, the "transformers" must possess high accuracy and hence are quite expensive.

Today, if measuring and recording are unnecessary, as is true in many cases, a small "tripping transformer" (see illustration) designed recently by the General

Electric Co., of Schenectady, N. Y., may be used in connection with the automatic device.

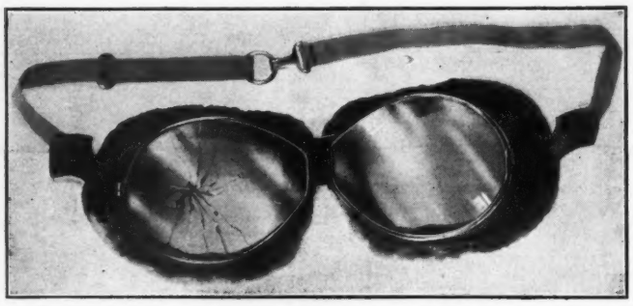
This eliminates the higher priced, more accurate transformer, and since the new device is accurate enough for tripping purposes, it offers a similar advantage; that is, it results in a simpler, cheaper and safer arrangement.

Although small and inexpensive, the new "invention" offers a convenient and satisfactory method of safeguarding valuable apparatus.

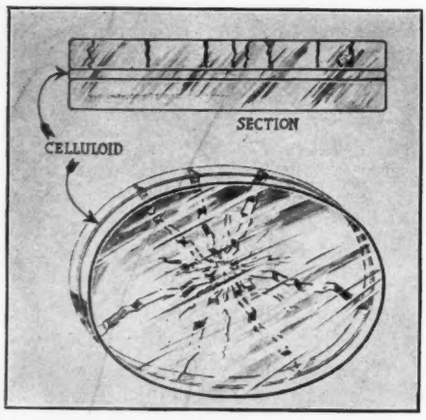
"Resistal" Safety Lenses for Goggles

Mining men who advocate the safety-first idea will be interested in a new "crystal" that has been developed for use in goggles and masks worn by workmen who are exposed to the constant hazard of flying chips or specks, dust, gas, or excessive heat and light which jeopardize their eyesight. The feature of the crystal is its remarkable resistance to breakage, its strength being such that it will stand up even under a hammer blow, while even on cracking there is no accompanying shower of glass chips and splinters to harm the eye of the wearer.

"Resistal" is the trade name of the glass which has been developed by the Strong Kennard and Nutt Co. of Cleveland, Ohio, and is used in the manufacture of these goggles. The construction is made plain by the



One lens cracked, but inner surface intact



Enlarged view and section of broken lens, showing safety feature

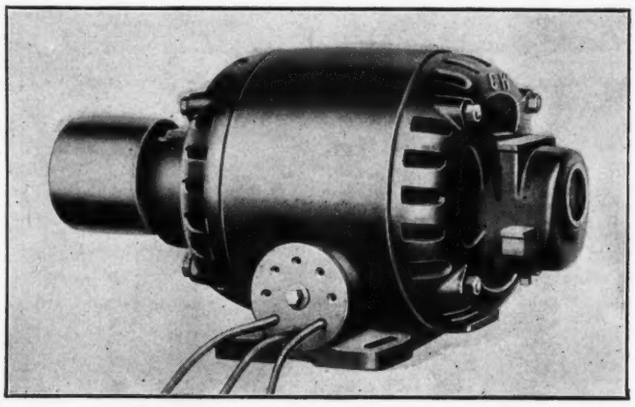
"RESISTAL" SAFETY LENSES IN USE

accompanying sketch. It comprises two layers of perfect optical glass, which may be either flat or curved, with a layer of celluloid interposed, the whole being welded—not cemented—into a solid mass. The result is a crystal for which is claimed every virtue of the ordinary glass with none of its dangers or drawbacks, having all of the strength and safety features of the celluloid goggle but, unlike celluloid, being unscratchable, rigid and fireproof. Neither is it affected by water, heat or cold, and the celluloid layer provides a heat-insulating medium which prevents "clouding up" due to moisture condensation.

As a testimonial of their worth is advanced the fact that "resistal" goggles have been adopted for the needs of the Aviation Corps, U. S. Army, while from the same quarter the makers have received orders for a large number of crystals for military gas-mask purposes. The fact that the glass remains perfectly gas- and water-tight, even when badly cracked, makes it particularly adapted for use in the latter application.

Crocker-Wheeler Induction Motors

The illustration shows a new type of squirrel-cage induction motor recently placed on the market by the Crocker-Wheeler Co., Ampere, N. J., and known as



SQUIRREL-CAGE INDUCTION MOTOR

the C-W Form P. These motors range in size from ½ to 3 hp. and are designed for constant-speed operation on 60-cycle, polyphase circuits. Among the features claimed for the machines are good starting torque, high power factor and good ventilation.

The stator housing is of cast iron and is cylindrical in form. The stator core is made up of sheet-steel laminations, riveted and bolted together. Windings are placed in insulated slots and treated with a moisture and acid-fume proof varnish. The rotor is also built up from steel laminations. Bearings are of bronze, with oil grooves so located as to distribute a film of oil regardless of the direction of belt pull. Motor feet are cast integral with the frame and are slotted to permit adjustment for belt tension.

Legal Status of Mining Machinery

On bankruptcy of a company engaged in placer mining in Alaska, it was established that an oil-burning combustion engine and other apparatus which were readily removable from the mine and which had been sold to the company under a contract reserving title in the seller until payment therefor, a condition which had not been met, could be reclaimed by the seller, not being subject to claim by the trustee in bankruptcy as part of the real-estate assets vesting in such trustee. This point was decided by the United States circuit court of appeals in bankruptcy proceedings against the Seward Dredging Co. (242 Federal Reporter, 225).

Events and Economics of the War

The second Liberty Loan was oversubscribed, the total reported to date being considerably over $5,000,000,000. A plot for a second Sinn Fein rebellion, backed by Germans and scheduled to take place in Ireland about Easter, has been exposed in this country. Chairman Scott of the War Industries Board has resigned and the Aircraft Production Board has been reorganized. The British embassy at Washington has released to the Swedish ambassador the pouches seized at Halifax. Steps to curtail non-essential production have been undertaken by the Government. The price of soft coal at the mines, as fixed by the Government, has been raised 45c. per ton by the President.

A great Teuton drive into northern Italy has won initial successes from Cadorna, over 100,000 Italians and 700 guns being captured with the towns of Gorizia, Cividale and Udine; the Italians are retreating within their own borders, intending to stand at the Tagliamento River; a credit of $230,000,000 has been given Italy by the United States. The Germans have shortened their lines on the Riga front by falling back. In France, more ground at Soissons and Ypres has been gained by Haig and Petain. At Berlin, von Hertling has succeeded Michaelis as chancellor. Brazil has declared war upon Germany.

Better Control of Munitions Needed

The resignation of Frank A. Scott from the War Industries Board has served to bring to a head the matter of reorganizing the munitions administration, according to the *Times*. A general expectation exists in Washington circles that in consequence of the situation a Department of Munitions will be created at the instance of President Wilson, with a Secretary having a seat in the Cabinet. All the civilians who have been helping the Government to bring about intensive production of munitions have urged the President to do this, and it is understood that Secretary Baker favors it also. One opinion is that the President may create such a department without delay and ask Congress, when it reassembles in December, to give legal authority for the organization.

The War Industries Board, of which Mr. Scott was head, is an unofficial body and supposed to work under the direction of the Council of National Defense. As a matter of fact, it is the all-powerful section of the Council and does practically all the administrative work with which the Council is intrusted. As it has no statutory standing it must depend on the Secretaries of War and the Navy to carry out its advice. The Board has, nevertheless, been uneasy under its lack of authority to meet directly the pressing needs of the nation. It has been hampered by lack of authority.

It is asserted that establishment of new munitions plants and the extension of present plants have been impossible to the degree desired by the Board, because it was unable to guarantee to munitions manufacturers that the Government would take care of their output. The feeling is that with the creation of a Department of Munitions by statutory authority much of the present embarrassment will be eliminated. The head of the department would be able to act without being hampered by the necessity of making all his actions *ad referendum*. Whether the Ordnance Department of the Army, which has come in for criticism, would be placed under the new department is a matter to be settled later, but the probability is that it would retain its position as a branch of the military establishment. This would leave to the Department of Munitions the production of munitions and their shipment, while the Ordnance Department would attend to ordnance supplies in the field.

State Fuel Administrators Confer

A conference of state fuel administrators appointed since the meeting on Oct. 2 was held in Washington on Oct. 26. The subjects discussed were: State organization methods, retail prices, methods of obtaining emergency coal supplies, methods of improving transportation, and conservation of fuel supplies. To the list of state fuel administrators previously published should be added the following names: For Pennsylvania, William Potter, Philadelphia; California, Albert E. Schwabacher, San Francisco; Arizona, Will L. Clark, Flagstaff; Minnesota, Judge John F. McGee, Minneapolis; North Dakota, I. P. Baker, Bismarck; Louisiana, John G. O'Kelley, New Orleans; Oregon, Fred J. Holmes, La Grande; Mississippi, C. L. Towns, Minter City; New York, Albert H. Wiggin, New York; Illinois, John E. Williams, Streator; Ohio, Homer H. Johnson, Cleveland; Michigan, William K. Prudden, Lansing; Indiana, Evans Woolen, Indianapolis; Colorado, William J. Galligan, Denver; New Mexico, former Governor William C. McDonald, Carrizozo; South Carolina, B. B. Gossett, Anderson.

Government Advances Price of Coal

An increase of 45c. a ton in the price of bituminous coal at virtually all mines in the country, effective from Oct. 29, has been granted by President Wilson. The new price will absorb wage raises recently agreed upon between operators and miners in the central competitive and other fields. The order provides that the increase shall not apply in case of existing contracts providing for an increase in price to cover any raise in miners' wages. Neither will it apply in districts where miners and operators fail to agree upon a miners' penalty provision satisfactory to the Fuel Administration.

Coal operators have been informed that 10% of the anthracite and bituminous coal output of the nation will be requisitioned by the Fuel Administration to meet the wide-spread shortage. The administration, it is understood, will direct operators to set aside the pre-

scribed percentage of their production to await orders. This free coal will be diverted into the districts where it is most needed. If an operator's output is wholly under contract, it appears that he will have to "shave" the contracts in order to set aside the required amount. The first step in this direction has actually been taken. On Oct. 29, the entire output of the coal fields of Ohio, western Pennsylvania and Michigan was ordered sent into the sections of Ohio and Michigan needing it most. During the same 24-hour period the priority order for shipment of bituminous coal to Lake points was suspended by order of the priority director of the War Industries Board.

John P. White, president of the United Mine Workers of America, has resigned to take up work as adviser to Dr. Garfield on labor problems. A. S. Learoyd, of New York, former Lackawanna general freight agent, has been appointed on the staff of the Fuel Administration to take charge of the distribution of anthracite coal. For the position of head of the Administration's transportation department, G. N. Snider, of New York, formerly coal traffic manager of the New York Central R.R., has been selected.

Curtailing Non Essential Production

The Government took steps on Oct. 27 to restrict enterprises not essential to the conduct of the war by forbidding the use of open-top freight cars on and after Nov. 1 for transportation of materials other than coal for roads and highways, theater construction and manufacture of pleasure vehicles, furniture and musical instruments, etc. Such cars are to be set apart for the exclusive use of the coal, metallurgical, sugar and fertilizer industries according to the new order, known as priority order No. 2. This is the first move on the part of the Government to curtail non-essential production. Regarding such a policy two courses have been generally discussed in Washington. Under one the War Industries Board would enter into voluntary agreements with specific manufacturers of non-essentials to reduce their output gradually. Under the other the President would issue a general request to manufacturers, and rely on their patriotism to follow the suggestion. The power behind both plans would be the Government's authority to hold up coal shipments to recalcitrant producers and to control transportation through the priority director of the War Industries Board.

Japan Would Control Chinese Iron

The Japanese are exerting every effort, officially and unofficially, to close the Chinese arms-monopoly contract, involving the control of the Nankin iron deposits, the employment of Japanese military advisers and a director of the new arsenal at Nankin. The Japanese say that they are extending credit and not making a loan and consequently, are not violating the Six Powers' exclusive rights to make political loans.

However, this view is not shared by the French and the English, and a large section of the Chinese press, as well as the diplomatic circle, which universally denounces the deal as a revival of the most objectionable features in Japan's demands—known as "Group V"—presented to China in May, 1915. The main provisions of those demands concerned the appointment of Japanese military and political advisers for China and related to Japanese supervision over the manufacture or purchase by China of munitions of war. Minister Reinsch has advised the Foreign Office that China invariably took the position that it would hold the remainder of the iron deposits for national use whenever Americans sought development rights, and that consequently the United States now would insist that consideration be given American interests in the Chinese iron industry. The ministers of several other countries have taken the same position.

Industrial Research in Great Britain

Such progress has been made in industrial research during the last year in Great Britain that a department has been created by the government for the work and a million pounds sterling voted for its encouragement. Many trades are seeking to establish research organizations among which are the coal-mining industry and the Scottish shale-oil and steel industries. The Privy Council, however, considers that many important fields cannot be covered by such associations.

Research into fuel is one of these, and a fuel-research board has been established, which intends, with the help of coal owners, to collect specimens typical of the coal seams of the various mining districts, and to examine and classify them. It is intended to investigate the nature and origin of the various types of coal and the behavior of their constituents under the action of heat and other agents, beginning with the well defined types of coal as they occur in commerce. The board has already published a report covering the resources and production of iron and other metalliferous ores, tungsten, the zinc industry, the smelting and refining of copper, and the qualities of copper and copper alloys.

Waterways Commission to be Named

Plans for greater utilization of navigable rivers to relieve railroads of the strain imposed by the war will soon be entrusted to a waterways commission of seven members to be named by President Wilson. This commission will be asked to give special consideration to encouraging transportation of heavy freight by barges on the principal waterways, to relieving harbor congestion at seaboard terminals, and to developing water-power quickly for war purposes. At least one of the commissioners must be an army engineer, according to the Rivers and Harbors Act; one must be an expert civilian hydraulic engineer, and the others may be selected from either civil life or the public service.

To Speed Ship Building

For the purpose of discussing the labor question and to evolve a plan of attracting men to shipyards which are said to need about 300,000 more workmen, steel shipbuilders were called to meet in Washington on Oct. 29 to confer with representatives of the Fleet Corporation, Department of Labor, Navy Department and the American Federation of Labor. The Government's steel

ship-building program needs speeding up as it is now 20 ships behind schedule. A second shake-up in the Emergency Fleet Corporation has been forecast from present conditions. The Corporation recently announced that one million tons of new ships would be afloat by Mar. 1 next, but, nevertheless, it is said that the construction is far less than war needs require. Amendment of the shipping law also is quite probable, so that there will not be two boards, as at present. One board is constructing ships, the other operates them. But where the first hesitates the other is powerless. That appears to be the difficulty today.

Scott Quits War Industries Board

Frank A. Scott, chairman of the War Industries Board of the Council of National Defense, delivered his resignation to Secretary of War Baker on Oct. 26. The reason advanced by Mr. Scott for his resignation was ill health. In his letter he referred to the "recurrence of a serious physical difficulty." Secretary Baker, as chairman of the Council of National Defense, accepted the resignation and designated Judge Robert S. Lovett, vice chairman of the War Industries Board, to assume the direction of the situation temporarily.

New Air Board Selected

Naval and military members of the Aircraft Board, about to be reorganized under a law giving it legal status, were announced on Oct. 26 by Secretaries Daniels and Baker. President Wilson is to name a civilian as chairman and two other civilian members. All of the service representatives appointed so far except Lieut. Commander Arthur K. Atkins of the Navy are members of the present board. They are: Navy—Rear Admiral Taylor and Capt. H. E. Irwin. Army—Maj. Gen. George O. Squier, Col. E. A. Deeds, and Col. R. L. Montgomery. Brig. Gen. Benjamin D. Foulers, Col. Raynal C. Bolling and Col. S. D. Waldon will be dropped, but will continue their services in connection with airplane production.

Restrictions on Press Defined

As interpreted by the Postmaster General, Albert S. Burleson, the Espionage and Trading-with-the-Enemy Acts make it unlawful for any person, firm, corporation, or association to mail, transport or carry, or otherwise publish or distribute, during the war, printed or other matter of the following kinds:

(1) Advocating or urging treason, insurrection, or forcible resistance to any law of the United States.

(2) Conveying false reports or false statements intended to interfere with the operation or success of the military or naval forces of the United States, or to promote the success of its enemies.

(3) Intended to cause insubordination, disloyalty, mutiny, or refusal of duty in the military or naval forces of the United States.

(4) Intended to obstruct the recruiting or enlistment service of the United States, to the injury of the services of the United States.

(5) The circulation or publication of which involves the violation of any of the numerous other criminal provisions of the Espionage act, but which are not of special interest to publishers.

(6) Printed in a foreign language containing any news item, editorial, or other printed matter respecting the Government of the United States, or of any nation engaged in the present war, its policies, international relations, the state or conduct of war, or any matter relating thereto, unless the publisher or distributer thereof, on or before offering the same for mailing, or in any manner distributing it to the public, has filed with the postmaster at the place of publication a true complete translation of the article.

(7) Referred to in the preceding paragraph for which publishers have been granted a permit to circulate, free of restrictions named therein, but which does not bear at the head thereof in the English language the fact that such a permit has been granted.

Lake Boats for Ocean Trade

To make the large tonnage on the Great Lakes available for use on the ocean during the four or five months that navigation is closed on the lakes, the United States Shipping Board may urge to the Canadian Government the advisability of rushing to completion the enlargement of the Welland Canal. The 800-ft. locks contemplated in the Canadian plans will permit the diversion of the great bulk of lake tonnage to the coastwise trade and in some cases to the transatlantic trade, according to officials of the board. They will also make possible the utilization of the immense shipbuilding facilities on the lakes which are sufficient for the construction of 140 ships per year at present and can be greatly increased, and will obviate the necessity of cutting such ships in two in order to get them to the ocean. The board is now bringing about 40 ships from the lakes, of which 24 must be cut in this fashion.

Eighteen Pounds of Metal Used in Equipment of Infantryman

A table showing that more than 18 lb. of metal enters into the composition of articles required for the equipment of each infantryman has been prepared by the Ordnance Bureau of the War Department. The metal equipment carried by each infantry soldier weighs 294.65 oz., consisting of 153 oz. iron and steel, 12.35 oz. tin, 62.7 oz. brass, 24.2 oz. aluminum, 36.4 oz. of metal in bullets consisting of lead, tin and cupro-nickel, and 6 oz. of other metal. An additional weight of 114.7 oz. is added by equipment of cotton, wool, leather and wood. The Ordnance Bureau, therefore, supplies each soldier with approximately 25 lb. of equipment, this being exclusive of that supplied by the quartermaster corps.

Chile Releases Nitrates

Nitrates reserved for German account have been released by the Chilean government and are now available for the munition purposes of the American and Allied Governments. Credits lodged with the German banks in payment have been transferred to an American bank in New York, so that the money as well as the nitrate can be used. The large demand has forced the price to more than $3.65 per quintal. As nitrate forms three-quarters of the exports of Chile, there has thus been effected a rise in Chilean exchange.

American Federation of Labor, through its executive council, has declined to participate in an international conference of workmen and Socialists of all countries, suggested by the executive committee of the Russian Workmen's and Soldiers' Delegates' Council.

Industrial News from Washington

By Paul Wooton, Special Correspondent

To Rehabilitate the Defense Council

Shorn of a portion of its effectiveness by Sec. 3 of the Food Control Act, the Council of National Defense has become more and more the target for criticism. Plans are being considered which will rehabilitate it and it is believed that it will not be long before the Council is again an important factor in the Government's war activities. Even as it is, it is carrying forward important work. Many of its committees are as active now as ever. The raw materials section under Bernard M. Baruch; the committee on chemicals, under Dr. William H. Nichols; the Aircraft-Production Board, of which Howard E. Coffin is chairman; the lumber committee and the committee on oil, headed by R. H. Downman and A. C. Bedford respectively, are continuing their work with unslackened energy.

In the rapid march of events, many have lost sight of the accomplishments of the Council of National Defense. Among them are the creation of the War Industries Board to act as a clearing house for the war-industry needs of the Government; under this board are handled vital war matters, having to do with raw materials, finished products and priority. It was this board which arranged for fixing the price of copper and steel with the producers. The procurement of vast quantities of raw materials for the use of the military and naval forces at prices greatly below the current market quotations was made possible by the coöperation of industrial leaders. The Defense Council is also responsible for the completion of an inventory of American manufacturing plants setting forth the aid they can extend toward carrying out the military plans of the nation; for the saving of millions of dollars by the coördination of purchases through the agency of the general munitions board; for the elimination of middlemen in the purchase of many of the supplies for the War and Navy Departments; and for the development of the Liberty motor and other aid in establishing an American aviation service, and standardizing the heavy-duty war truck. The enlistment of reserve-engineer regiments to aid in rehabilitating the railroads of France was also due to the Council's work.

Examining Manganese Properties in Virginia

An outcome of the work of the war minerals committee, composed of a representative of the American Institute of Mining Engineers, the United States Geological Survey, the United States Bureau of Mines and of the state geological surveys, is an examination of Virginia manganese properties to be made by four prominent mining engineers, namely, Philip N. Moore, F. Lynwood Garrison, Prof. Robert H. Richards and Allen H. Rogers. These men are now in Virginia and will follow a program arranged by Dr. Thomas L. Watson, the state geologist, in coöperation with the manganese miners of the state. Mining and milling methods that will improve production will be considered as will the problem offered by the inadequate water supply at most of the mines during certain seasons of the year.

Export of Cyanide to Mexico

Users of cyanide in Mexico will have to form an organization to undertake the fair distribution of that chemical before supplies may be exported to any extent. In spite of the secrecy with which the War Trade Board shrouds itself, it is possible to predict this with a fair degree of certainty.

Representatives of several mining companies operating in Mexico have been trying for several weeks to get a ruling on this question. All applications for licenses have been refused by the Board with the result that the Mexican operators are in a bad way, many of them having been forced to close down. The thousands of workmen thus made idle are not disposed to take the hardship kindly. They have been accustomed to taking the law in their own hands during recent years and at many properties are threatening trouble if wages are interrupted.

It is regarded as probable that the War Trade Board has delayed action on this matter pending an investigation of the domestic situation and that it has found that, although there is reason for the conservation of cyanide, enough will be forthcoming for the actual needs of the domestic mining industry and still leave some for Mexican use.

New Mining Law Drafted by Mexico

Mexico's new mining law has been drafted and is now being scanned critically by a special commission, according to the semiofficial news bureau, which is maintained in Washington by the Mexican Government. As soon as the commission has completed its work on the tentative draft, it will be submitted to the Chamber of Deputies. From the same source it is learned that Mexican authorities are taking energetic steps to prevent the clandestine removal of kelp from Mexican waters. The activities of those supplying the seaweed to the potash-recovery plants are alleged to have extended far along the coast of Baja California.

Export of Tin Plate Restricted

With regard to licensing exports of tin plate, the War Trade Board makes the following announcement:

(1) That no licenses will be granted for the exportation of tin plate for use for any other purpose than as food containers, except on satisfactory evidence that the plate will be used in such a way as to contribute to the military needs of the nations at war with Germany and her allies; (2) that, as to applications for license to export tin plate to be used as food containers, preference will be given to those cases in which satisfactory evidence is presented that the food to be packed will be for the use of the nations at war with Germany and her allies.

Editorials

Recruiting a Mining Regiment

WE HAVE received from Maj. O. B. Perry of the Engineer Officers' Reserve Corps (formerly general manager of the Yukon Gold Co.) the following dispatch, dated at Washington, D. C., Oct. 31, 1917:

We are today mailing to mine managers throughout the country an appeal for aid in securing volunteers for mining service in France. Our letter contains the following announcement:

"The Engineer Corps of the United States Army has been authorized to raise by voluntary enlistment a special mining regiment to consist of six companies of 250 men each and to be known as the 27th Engineers National Army. The regiment is now being recruited. The first company has been formed and is in training at Camp Meade, Md. This regiment is to be made up entirely of picked men from the various mining sections of the country. All trades and occupations in and around a mine will be represented and each company will have a sufficient number of men skilled in each trade to enable it to operate as a unit. The work to be done is purely military in character and what is known as first-line work consists of the preparation of underground shelters for the fighting troops and the placing of explosive mines. This work requires a high degree of skill in rapid tunneling construction and involves the handling of all sorts of material from clay and chalk to hard rock. In addition to the regular engineer equipment each company will be provided with special tools such as tunneling and boring machines, drills, compressors, hoists, lighting sets, etc. While most of the work of the 27th Engineers will be underground mining, the regiment will be trained to fight as well as to mine. The commanding officer will be a regular-army engineer officer, the remaining officers of the regiment being largely drawn from the mining engineers who have volunteered their services and who have been given the necessary military training at the officers' training camps. The 27th Engineers offers a great opportunity for the miners of this country to show their skill and courage. Any experienced mining man who wants first-line service in France is urged to enlist at once."

We urge upon mine managers their hearty coöperation in recruiting this mining regiment which will be the special representative of the mining industry at the front in France.

The Second Liberty Loan

THE second Liberty Loan has been floated successfully, the maximum amount being oversubscribed. The number of individual subscriptions surpasses expectations. Every industry and class is represented. Any doubts concerning America's sincerity, unity and efficiency, both among those directing Governmental affairs and individuals comprising the nation are thus removed. As for the future, it may be safely assumed from this vigorous demonstration that the country will shoulder her responsibilities.

The mining industry did its share nobly as shown by the subscription lists, which we should like to publish, though it is impractical because of their present incompleteness. Not only the financial interests directing the production of mines but also the miners have loyally contributed. Butte, a striking example, recently torn by labor strikes, infested with agents of the German propaganda and charged with disloyalty by some unduly excited pessimists, has responded so as to leave no doubt regarding the patriotism of this mining center. As in Butte, so throughout the country. Thus, not only has the Allied cause gained by the intrinsic value of the loan itself for necessary munitions, but deeper is its significance, in the showing of national unity and firm purpose of maintaining democracy.

Labor Troubles Ended

THE labor troubles in the metal mining industry, which upset conditions so seriously last summer, now appear to be ended, but it will be a long time before the rate of copper production of last May will be regained, especially in Montana and the other northern districts. The working population everywhere has been reduced by the draft into the army. This, of course, affected all districts equally. During the period of idleness, many men went out prospecting and hunting, from which they have not yet returned but they may be expected to come back with the advent of cold weather. However, there is a migratory working force that moves to Montana in the spring, and back to Arizona in the fall. We think it is doubtful if the copper production of the United States will rise much above 80 to 85% of the rate of 1916, except in those districts where the mining is done in openpits, and a lower grade of labor than underground miners is used.

In lead and zinc mining there must be now a surplus of men owing to the curtailment of production. It would be an excellent thing if such men could be diverted to copper mining, but the nation does not possess the machinery for accomplishing any such transfer. We are now deprived, moreover, of the incentive of increasing prices and increasing wages. The marvelous strides in production that occurred in our industries previous to the middle of 1917, are ascribable to the free play of natural conditions. We are, of course, going to pay a penalty for interfering therewith. Nobody ever interferes with nature without suffering some disagreeable consequences.

Valuation of Mines

THE allowance that the Federal Tax Law permits for depletion of mines, as a deduction from gross income, is based on a valuation of the mine and embodies the indispensable factor of life of the mine, as any such valuation must do. The cases of mines possessing delimited orebodies, such as the porphyry copper mines, are capable of comparatively easy computation, although even in those cases the result cannot in the nature of things be anything more than a rough approximation. In the cases of mines possessing veins or orebodies that descend vertically to great depths, which cannot practically be delimited, the life of the mine is highly uncertain. The proprietors of such

mines are confronted by two horns of dilemma. If they reckon a short life, they will obtain a large immediate deduction for depreciation; but, if they figure on the basis of five years, let us say, and at the end of that time the mine proves to be as productive as ever, with no end in sight, the proprietor will have used up his allowance for depletion, and will, moreover, be exposed to the risk of changes in legislation that will make taxation even more onerous than it is now. But, anyway, there must be a valuation of the mine. We prophesy that there is going to be in the near future more work for mining engineers who have made a specialty of mine valuation than there has ever been in previous history.

The Jump in Silver

SINCE the high point of silver prices was reached in September the quotations have been gradually declining, almost every day showing a falling off, until a level was reached of 41⅞d. in London and 82½c. in New York. This was low compared to the September rise, but still a high point relatively to those of the last two years. Several causes combined to bring down the quotations. Among them may be mentioned the absence of larger European purchasers for coinage; a decreased demand from India caused by Government embargoes; an absence of buying from China; and the failure of the reported sale of a large amount in Mexican pesos to the United States. To these may be added the larger supplies which were drawn out of reserves by the high prices; these furnished the market with quite as much as it was prepared to take, or even more.

On Oct. 30, however, there was a sudden turn, a jump upward amounting to 3d. in London or 6c. in New York, a greater change than has been experienced in one day for a long time. This carried the current price to 90⅝c. in New York, which is still below the September level, though high in comparison with the earlier months. There has been a general feeling that the fall had been greater than was warranted by the underlying conditions of the market, and that some advance was to be expected soon, but so sharp a turn was hardly looked for. Here again a combination of causes is to be noted. Deliveries have been rather slow, a number of orders have been received, more licenses have been issued for imports into India, and there are reports that Australia has been unable to meet the current demands for China. Besides these there is something speculative in the sharp turn, which has doubtless embarrassed some London and New York operators who were not able to make deliveries as promptly as they were required. The fact that there have been no dealings in futures for some time past doubtless helped to emphasize the sharpness of the turn.

As to the future, coinage demands are sure to continue large and the requirements from the Far East will remain steady if they do not increase. There is no increase in production apparent anywhere. The Mexican surplus is not likely to come on the market suddenly, since it is not large in amount and its existence is well known and discounted. Trading may be slow and to some extent delayed by the current embargoes in various quarters. The indications, however, point to continued high prices, even if there is no further advance.

The Tax Law

THE more the new tax law is examined and studied, especially as to the war profits section, the more confused, indefinite, and inequitable does it appear to be. Even the Commissioner of Internal Revenue and his assistants, upon whom devolves the interpretation of the law, admit their own inability to unravel the meaning of some paragraphs and concede the unfairness of the provisions of other paragraphs that are reasonably clear. There is talk of appointing an advisory board of experts—chosen from among business men—in the Bureau of Internal Revenue to analyze the law and give advice to the Government in the drawing up of the regulations necessary to make it effective, but it is recognized that not even such a board can help in matters where the language of the law is clear and admittedly unfair.

The major difficulty appears to be in the inadequate definition of capital, a percentage of which determines the tax that any corporation must pay. Corporations are not allowed to reckon as capital their investments in the stocks of other corporations, although in fact the largest part of their capital may be employed in that way. But over and above everything looms the principle that concerns of small capitalization are taxed out of all proportion to concerns of large capitalization that are doing the same business and earning the same net income. Many of these corporations, like railways and banks, have not enjoyed any war profits at all. On the contrary, the economic position of the railways, especially the Eastern roads, has become rather desperate. Manifestly, a revision of the war-tax law will be necessary when Congress reassembles in December. It is to be hoped that then the stupid Congressmen, who have so little knowledge of business affairs, but who played so great a part in enacting the present law, like Mr. Kitchin, of North Carolina, can be relegated to the background. The exhibition of their incompetence that we are now having ought to be sufficient.

Controlling the Distribution of Explosives

IT IS most necessary at this time to regulate the distribution of explosives lest any fall into the hands of those who are only too ready to use them for hindering the progress of the war. The Explosives Act was passed to make such control possible and the Federal Bureau of Mines is now endeavoring to draw up the details of administering it. But the task, which never looked easy, is proving more difficult than at first anticipated. So widespread has the use of explosives become, not only in mining and allied industries, but in agriculture, that it is apparent that many men, who might otherwise be productively employed, will be needed to enforce the provisions of the Act.

It is in the preparation for licensing all persons who handle explosives that the Bureau is finding its greatest task. Experienced men in the industries concerned have been asked to aid in the work and a large number of clerks working day and night is employed. The state inspectors to be named by the President, as provided in the Act, have not been appointed, with the result that

the entire matter must be handled from Washington by an organization but temporarily effected. The chief problem confronting the Bureau is the selection of a licensor for every county throughout the land. The county clerks are being chosen for the work for the most part, except where the size of the county or the extensiveness of mining operations therein make necessary the appointment of deputies and other officials. The complexity of the problem is further emphasized by the fact that the distribution of ingredients of explosives as well as explosives themselves must be controlled. It will therefore be necessary to license manufacturers and retailers of drugs and chemicals though to what extent no decision has been reached. Thus it is seen that the work confronting the Bureau of Mines in administering this important act has already assumed large proportions.

The possibility of Government operation of mines is discussed on another page in this issue and brings forcibly to mind the close parallel with Great Britain that our affairs have followed since we entered the war. Strikes for higher wages were among the first evidences of the failure of industry generally to recognize the great jump in the cost of living. We marveled at the time that the British miners and other workmen could be so unpatriotic as to strike, and later we found the same difficulties, with slight variations, reducing the output of our copper mines and then of the shipyards. Labor in the mines and the essential industries will probably determine the outcome of the war. Great Britain and France have both found it necessary to establish practical conscription of industry. While an unpleasant prospect, it looks very much as if this country may be forced to the same course.

In our editorial last week on "War Taxes on Mining Companies," we fell into error in saying that "the Kennecott Copper Co., on the other hand, which owns a large interest in Utah, will get the benefit of its investment in Utah on the basis of something like $110 per share." We overlooked that the new tax law prevents corporations from including in their capital their investments in other corporations.

BY THE WAY

Two new minerals are reported from California. They have been christened "crestmoreite" and "riversideite," presumably named from the locality in which they were found. According to the press dispatch, crestmoreite is a hydrous basic orthosilicate containing small amounts of other oxides in place of silica; riversideite a hydrous lime sulphate.

The creation of a multiplicity of bureaus, supposedly to facilitate the dispatch of official Governmental business and other people's business recalls an old Colorado anecdote. A tenderfoot had been appointed station agent and general factotum at the terminus of a small and unimportant branch railroad, served by an accommodation train once per day or once per week—we forget which. Some prospector had shipped to that point a "Rocky Mountain canary." After the train departed the agent sized things up as well as he could, heaved a sigh, and then laboriously reported over the wire: "Short, one bureau; over, one donkey."

After setting the automatic shift-boss indicator at the entrance to the stope, Jerry and Bill, both zealous students of mining by the short-cut route, sat down for a smoke and a friendly discussion of lesson paper 27. "Sure an' there must be big money in thim rare earths," said Jerry. "I seen in the super's minin' paper where the guv'mint in Injia is all worked up over a dayposit some av thim fellies diskivered *in situ*." Bill, not to be outdone in any display of erudition, spat contemptuously down the chute. "India, hell. Situ is a Japanese island."

Why prospects are not sold is explained by the following communication received by one of the large mining companies from an Arkansas "mine" owner: "We have a twelve (12) acre pocket of very rich ore, running heavy with gold, starting at a depth of seven (7) feet on the surface, and the deeper we go the richer it runs in gold and other valuable metals, and when we got to a depth of 370 ft. we went through a very rich bed of 30 to 40 ft. of pure, free gold and platinum, running about ¾ gold and ¼ platinum, and very little rock. We are now open for a business proposition with you, and would contract with you for many hundreds of thousands of tons of this ore. We could send you samples, but do not feel it necessary, for your representative can see for himself the richness of this ore." Thousands of such letters are received each year by the leading mining operators. After Nov. 2, the answers will require 3c. postage.

The early history of well-known mines becomes shrouded with inaccuracies as time goes by and the original locators disappear. The discovery of the Santa Gertrudis mine in Mexico by a Cornish engineer is reported in the London *Financial Times*. While presiding at the annual meeting of the Grenville United Mines in Camborne, Thomas Negus remarked that he had seen in the *Cornish Post* a report dealing with the Santa Gertrudis mine and added: "There are not many here who know that mine, or the facts I am about to record. It was in the year 1867, when I was one day surveying, that I found the Santa Gertrudis lodes and their continuation. I made notes, and within a day or two saw the late Capt. William Stoneham, who, with myself, took up a piece of the ground and commenced work. We worked on for a little time until we were offered a place 150 miles in the interior of the country, and we left this bonanza to go to another bonanza, which did not prove to be as good as the first would have been had we stuck to it. The Santa Gertrudis mine has yielded thousands of pounds sterling in profits since I left the country. I only wish I had remained there and kept my interest in the property, but we cannot foresee these things, and when we think we are making a move in the right direction, and do it for the best, the reverse often happens." Sticking by a property in Mexico is not such a pleasant task, today, even for a Britisher with a government that stands squarely behind him.

Harry J. Cantwell

BY H. A. WHEELER

The mining industry of Missouri lost one of its most active workers and boldest pioneers through the untimely death of Harry J. Cantwell, of St. Louis, last August, at the age of 59. Although trained as a lawyer, in which profession he was exceptionally capable, his tastes and interests were mainly devoted to mining. The frontier or development stage of the industry appealed strongly to his bold foresight and optimistic temperament, which coupled with excellent judgment, resulted in opening up successfully a much larger number of properties than usually befalls the pioneer. The very successful Central, the Columbia and the Catherine lead companies were promoted by him when but little was known of the now famous disseminated lead belt of Southeastern Missouri and when few had confidence in its low-grade ores.

Mr. Cantwell's first undertaking was the development of the area that became the property of the Central Lead Co., of which he was president for a number of years. Upon termination of his connection with that company, he acted for the St. Louis Smelting and Refining Co. in acquiring lands that it developed, the company now being one of the largest producers of the district. He next organized the Columbia Lead Co., also in the Flat River district, and became its president, and about the same time organized and conducted the Catherine Lead Co. in the neighborhood of Mine la Motte. He later became interested in mines in the vicinity of Palmer, in Washington County. He always had a firm conviction that some day the disseminated lead deposits of St. Francois County would be traced westward into Washington County.

As usually happens to the pioneer, his followers and successors reaped very much greater financial rewards than Mr. Cantwell, but he never complained of his meager returns and he was always ready to put his indomitable energy into any new mining proposition that would stand critical analysis. While his mining training was derived in the "University of Hard Knocks," he always had his propositions checked up by able experts before he invited his numerous friends to join him in new enterprises that his high integrity attracted. He promptly recognized the unusual merits of the new Miami zinc district in Oklahoma, and was in the midst of several highly promising deals when he was suddenly stricken about a year ago with paralysis, from which he never recovered. It is said of him that during 1916 he interested more capital in the Miami field than did any other one man.

The term "promoter" is not apt to invite confidence in the board rooms of bank directors and some silk-stocking business men avoid contact with this type of business pioneer; but the financial world would be thrice blessed if it had many H. J. Cantwells, while the mining industry would expand and justly thrive were there more such able, energetic, high-minded promoters. For he was a pioneer, operator and promoter through whose efforts the wealth of this country and the output of lead and zinc has been greatly increased.

Although bristling with energy and action, his charming personality, his wealth of good stories and anecdotes and his breadth in matters of general interest endeared him to a wide circle of admiring friends who will hold his memory dear as a real man—a broad-gaged, wholesouled, energetic optimist who more than made two blades grow where one blade had a struggling existence.

Mining Conditions in Mexico

R. T. Bayliss, chairman of El Oro and a number of other important mining companies in Mexico, and long a close student and keen observer of conditions in that country, reviewed in his annual report the conditions that confront mining companies in their attempt to operate in Mexico at this time. Part of his speech at the meeting of the Buena Tierra Mining Co. in London, on Sept. 18, is reproduced below:

"I regret extremely that I cannot at the moment give you any forecast as to when operations may be resumed. The advices we receive from our general manager and from our consulting engineer do not encourage us to expect any resumption of work during the current year, and it is most difficult at the moment to put a period to the conditions that prevail. Looking at the position of Mexico generally, there is no doubt that during the last 12 months conditions have improved—that is to say, there has been almost a complete cessation of active fighting. From another point of view, however, they cannot be said to be much better. The new constitution, which was adopted in May this year and which is ultra-democratic in character, and the decrees which it confirms, and others which have been put in operation since its passage, make the operation of any mining company extremely difficult. Very wide powers have been granted to labor and to committees of labor practically to adjust the rate of wages and otherwise to penalize the employer.

BUENA TIERRA TAXES QUINTUPLED

"Onerous taxation has been imposed on the gross output of mining companies throughout the Republic, and in the case of low-grade mines this taxation is so heavy that it will practically absorb all the profits of the undertakings. In the case of this company, the tax paid on the output of the year 1912, which was the nearest approach we ever had to a full year's work, would on the present scale have amounted in that year to $25,830 instead of $5869 which we then paid. The constitution further provides that only Mexicans by birth or by naturalization and Mexican companies shall have the right to acquire possession of land, mines and so forth; but inasmuch as a limited company like this cannot naturalize itself, it is permitted that the state may grant the same right to foreigners and foreign companies, providing they are willing to consider themselves as Mexican citizens with respect to such properties and consequently undertake not to invoke the protection of their governments in any matters relating thereto under the penalty of forfeiting the properties they hold. We are advised that the British Foreign Office will not permit us to make any such renunciation, and I need hardly tell you that we would not dream of doing so under any conditions even if this prohibition did not already exist.

"When I say, however, that the position in Mexico has somewhat improved during the last 12 months I must except the State of Chihuahua and two or three

other northern states of the Republic. The conditions in Chihuahua itself are worse than they have ever been, for there is no semblance of any government therein, democratic or otherwise. While there has not been any serious fighting round the City of Chihuahua during the year, there have been constant raids both of the Carranza forces and those under General Villa. Sometimes one side has been successful and sometimes the other. This, of course, completely destroys the possibility of any transportation facilities; and until one side or the other obtains permanent dominion over this district I am very much afraid we must expect the present conditions to prevail. I think it may be truly said of the Buena Tierra company that it has encountered the worst of bad luck ever since its incorporation. The revolution commenced within a few months of that date, and in consequence we have never yet had one completed or uninterrupted year's operation.

"It has always seemed a tragedy to me that a country like Mexico, so rich in mineral and otherwise so prolific, should have fallen on such evil days. It may be that it is nearing the point of recovery. I trust this may be so, but I doubt very much whether that recovery will be hastened by placing its population, over 80% of which is totally uneducated and illiterate, under what appears in the recent constitution to be a form of rampant socialistic democracy."

At the annual meeting of the El Oro Mining and Railway Co., on Oct. 4, in London, the directors reported that the audited accounts for the year ended June 30, 1916, had only recently been received and that the accounts to the end of June last were not expected to be available before the end of this year. Continuing, the directors' report says: "As stated in the last annual report, the management was compelled, much against its own judgment and the inclination of the directors, to re-start milling operations on Oct. 20, 1916, under threats of confiscation of the property and other penalties if this course was not adopted. The reduction works have since been kept in operation with more or less satisfactory results. Owing, however, to the present high cost of operation, mainly due to the enforced payment of excessive wages to the workmen and to the provisions of the constitution recently enacted, the company at present is not making any appreciable profits. The directors desire to impress upon shareholders the impossibility of laying detailed information with regard to the operations at the mine before them at this juncture. At the moment the operation of mining properties in Mexico has reached a crisis at which the industry must either terminate or be conducted under less onerous conditions."

Scant Profit in Black Sands

Investigation of the black sands in the Northwest (presumably Oregon, Washington and northern California) by the United States Bureau of Mines has led to the conclusion that the exploitation of them offers no promising commercial possibilities. While gold and platinum in limited quantities are found in them, the deposits do not seem sufficiently rich and extensive to justify development. It is admitted that isolated instances may be found where the sands may be worked profitably.

October Mining Dividends

Dividends disbursed in October, 1917, by 48 United States mining and metallurgical companies making public reports amounted to $9,778,910, as compared with $13,728,122 paid by 45 companies in October, 1916. Holding companies paid $348,139, the same as a year ago. Canadian and Central American companies paid $1,287,137 as compared with $1,769,761 in October, 1916.

The decrease in the disbursements by United States companies from the amount for the corresponding month last year, was a little less than $4,000,000; this is partly accounted for by the New Jersey Zinc Co. payment last year of an "extra" amounting to $3,500,000, no similar item appearing in this year's list. It should also be noted that there have been decreases in the dividend rates of such companies as Osceola, Isle Royale and North Butte, which are affected by unfavorable labor conditions, price-fixing and prospective war taxes.

United States Mining and Metallurgical Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$4.00	$800,000
Allouez, c	Mich.	3.00	300,000
Am. Smelters, pfd. A	U. S.-Mex.	1.50	175,257
Am. Smelters, pfd. B	U. S.-Mex.	1.25	375,000
Arizona Commercial c	Ariz.	.50	132,500
Arizona Copper, "A" Pref	Ariz.	.06	9,600
Big Creek Leasing	Ida.	.50	2,500
Bingham Mines, c	Utah	.50	75,000
Blockhouse, z	Wis.	1.00	20,000
Butte Bullwhacker, c	Mont.	.01	10,000
Caledonia, l. s	Ida.	.03	78,150
Cerro Gordo, l. z	Calif.	.05	50,000
Champion, c	Mich.	6.40	640,000
Continental Zinc	Mo.	1.00	22,000
Cresson, g. s	Colo.	.10	122,000
Daly	Utah	.10	15,000
Derry Ranch Gold Dredging	Colo.	5.00	5,000
Douglas	Ida.	.01	8,525
Dragon Cons	Utah	.01	18,750
Empire Copper	Ida.	.05	50,000
Golden Cycle, g	Colo.	.03	45,000
Hecla, l. s	Ida.	.15	150,000
Homestake, g	S. D.	.65	163,254
Inspiration, c	Ariz.	2.00	2,363,934
Iron Blossom, s., l. g	Utah	.05	50,000
Isle Royale, c	Mich.	1.00	150,000
Judge Min. and Smelt., s. l. z	Utah	.25	120,000
Mammoth, g. s. l. c	Utah	.10	40,000
New Idria, q	Calif.	.50	50,000
North Butte, c	Mont.	.25	107,500
Osceola, c	Mich.	2.00	192,300
Portland, g	Colo.	.03	90,000
Prince Cons., l. s	Utah	.05	50,000
Richmond, l. s	Ida.	.02	16,800
Shattuck Arizona, c	Ariz.	1.25	437,500
Silver King Coalition, s., l. z	Utah	.15	187,500
Silver King Con., l. s	Utah	.15	103,287
Tintic Standard, s. l	Utah	.02	23,350
Tonopah Belmont, g. s	Nev.	.12½	187,504
Tonopah Min., s	Nev.	.15	150,000
United Copper	Wash.	.01	10,000
United Eastern, g	Ariz.	.05	68,150
U. S. Smelting, com	U. S.-Mex.	1.25	438,894
U. S. Smelting, pfd	U. S.-Mex.	87½	425,555
United Verde, c	Ariz	1.50	450,000
Utah Apex, c	Utah	.50	264,100
Vindicator, g	Colo.	.03	45,000
Wellington Mines, g	Colo.	.10	100,000
Wolverine, c	Mich.	6.00	360,000
Yellow Pine, z. l	Nev.	.03	30,000

Canadian and Central American Companies	Situation	Per Share	Total
Cons. Min. & Sm. Co., c. z	B. C.	$0.62½	$260,445
La Rose, s	Ont.	.05	74,931
McKinley-Darragh-Savage, s	Ont.	.03	67,431
N. Y. & Hond. Rosario	C. A.	.50	100,000
Nipissing, s	Ont.	.50	600,000
North Am. Magnesite	Que.	5.00	9,330
Standard Silver Lead	B. C.	.05	100,000
Temiskaming, s	Ont.	.03	75,000

Holding Companies	Situation	Per Share	Total
California Explor	Calif.	$0.12	$28,139
St. Mary's Min. Land, c	Mich.	2.00	320,000

The Continental Zinc Co. and New York & Honduras Rosario designated their payments as distribution of capital and "payment from amortization fund," respectively. Utah Apex paid 50c. a share, one-half of which was designated as distribution of capital.

The totals for the first ten months of the year are as follows: Mining and metallurgical companies, $179,201,367; holding companies, $4,979,361; Canadian, Central American and Mexican mines, $16,381,857.

Personals

Victor Rakowsky, of Joplin, Mo., is in New York for a few weeks.

A. W. Allen has left New York for Denver and expects to be away for several weeks.

A. W. Newberry will be at the Engineers' Training Camp, Vancouver, Wash., until Dec. 1.

C. A. Burdick, of New York, has returned from the South, where he has been engaged in manganese examinations for two weeks.

Lee Wilcox, chief engineer for the Republic Iron and Steel Co., with headquarters at Gilbert, Minn., has been transferred to the Duluth office of the company.

Charles F. Jackson, formerly chief engineer for the Arthur Iron Mining Co., at Hibbing, Minn., has accepted a position with M. A. Hanna Co., at Cleveland, Ohio.

George Readman, director of the Arizona Copper Co., Ltd., of Edinburgh, Scotland, has been elected chairman of the board in place of Lord Salvesen, who recently retired.

Harry W. Newton has joined the staff of Falkenburg & Laucks, chemists and metallurgists of Seattle, Wash. He will have charge of the ore-testing department of the company.

C. W. Lawr, who has recently been in Butte, Mont., experimenting with the briquetting of manganese concentrates for the Butte & Detroit Copper and Zinc Mining Co., has returned to Esqueda, Sonora, Mexico.

F. Jenkin, assistant general manager of the El Oro Mining and Railway Co., Ltd., of London, operating mines at El Oro, Mex., has resigned his position. He has been with the company since its formation in 1899.

Carmi A. Thompson, of Duluth, has been appointed general manager of the Lake Superior iron-ore properties of the Tod-Stambaugh Co., of Cleveland. Mr. Thompson has been general manager of the Great Northern Ore Properties for over four years.

Theodore Pilger, mining engineer and geologist of the Butte & Superior Mining Co., is returning from an extended trip through Alaska, where he has been examining properties in the Willow Creek district as well as coal properties at Matanuska and Chickaloon, along the new Government railway.

Philip Laurence Foster, of the London Exploration Co., has resigned as a director of the Greene-Cananea Copper Co., having been appointed a captain in the Signal Corps of the United States Army. His place has been filled by the election of **Robert M. Raymond,** who represents the same interests.

Dr. Louis D. Ricketts has been appointed to take charge of mining and other operations of the Calumet & Arizona Mining Co. during the absence of General Manager **John C. Greenway,** who has joined the colors. Mr. Greenway recently handed in his resignation which was not accepted, indefinite leave of absence being granted him instead to enable him to go to France with the United States Army.

James J. Martin is general manager of the Chiksan Mining Co., of Yokohama, Japan, which is engaged in gold lode and placer mining at Chiksan, Korea. The members of the mine staff are J. S. Bradford, general superintendent; H. A. Stewart, superintendent Sajunkohl mine; W. L. Farnham, superintendent Moonsukohl mine; J. M. Truby, superintendent Yangdei mill; H. A. DeWitt, superintendent cyanide plant, assayer and surveyor; C. Harbottle, master mechanic; C. W. DeWitt, Sajunkohl mine foreman; W. B. Thorsen, Sajunkohl underground foreman; A. L. Hollway, night foreman Yangdei mill; J. M. Scott, store accountant; M. Kudzehara, superintendent agriculture and transportation; C. M. Truby, auditor.

Obituary

William Matson, a pioneer in the development of the oil fields in California, died in San Francisco on Oct. 11. He built the first independent pipe line from the California fields to the ocean.

Leo von Rosenburg was found drowned in the East River at Brooklyn, N. Y., Oct. 15. He had been missing only two days and there was nothing to indicate whether his drowning was caused by accident, foul play or suicide. He was 57 years old, was born in Austria and educated there, with a short course at Freiberg. He came to this country when a young man and his first work here was in the engineering department of the Lehigh Valley R.R. Co., which was then building its extension from Easton to Perth Amboy. He was a draftsman of exceptional attainments and afterward prepared, under the supervision of chief engineer Sayre, a monograph on the Musconetcong tunnel, which was very finely illustrated. Later he went to California and engaged in mining engineering. He practiced also for some years in Colorado, Montana and Missouri. In recent years he spent much time in New Mexico and Arizona. His last residence was in Flushing, N. Y., and he maintained an office in New York.

Societies

American Institute of Mining Engineers—The organization of a Tulsa section has been authorized and by-laws are being drafted. It has not as yet been determined whether the membership will be recruited solely from the oil industry or will be made to include representatives of the zinc and lead districts also.

American Institute of Electrical Engineers, Denver section, held its first regular meeting of the season on Oct. 20, at the Denver Athletic Club. A paper was presented by R. D. George, state geologist, on the "Oil Possibilities of the Rocky Mountain Region," which was of special interest to the mining men present. The various favorable oil formations in the state were discussed, and special attention was called to the great opportunities existing in the infant shale-oil industry in Colorado. The electrical engineers were concerned in the possibility of developing a demand for new electrical equipment.

New York Sections of the American Chemical Society, the American Electrochemical Society and the Society of Chemical Industry held a joint meeting in New York on Oct. 19. Prior to the meeting honorary membership in the Chemists' Club was conferred upon Major Victor Grignard, professor of chemistry in the faculty of science of the University of Nancy, France. The following papers were presented: "Some Problems in Filtration," W. L. Jordan, Los Angeles, Calif.; "The Pigments of the Tomb of Perneb," Maximilian Toch, New York; "Technical Applications of Nephelometry," P. A. Kober, Albany, N. Y.; "Titanium and its Industrial Applications," A. J. Rossi, Niagara Falls, N. Y.

United Engineering Society's Engineering Council met on Oct. 11 in the rooms of the American Society of Mechanical Engineers, Engineering Societies Bldg., New York. The rules committee submitted a draft of rules for the admission of other societies to the Council and progress was made in their consideration. The Council at present is composed of 24 members, five being appointed by each of the four founder societies and four by the United Engineering Society. The founder societies are the American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers and the American Institute of Electrical Engineers. The committee on public affairs reported on a number of requests that the Council support pending or proposed legislation. Remedial laws intended to promote hydro-electric development were favored and the Council voted to offer its cooperation to the United States Chamber of Commerce which is interesting itself in this matter. A movement to coördinate, unify and strengthen the work of various engineering committees coöperating with the Federal authorities at Washington was favorably considered. H. W. Buck and Charles Whiting Baker were appointed Council conferees.

Industrial News

Merrill Metallurgical Co., of San Francisco, has been apointed Pacific Coast representative of the Jonathan Bartley Crucible Co., of Trenton, New Jersey.

Asbestos Protected Metal Co. of Pittsburgh, Penn., announces the opening of a sales office in the Union Central Building, Cincinnati, under the direction of J. C. Lathrop.

Walter A. Zelnicker Supply Co. has recently secured the services of W. H. Bramman, who is acting in the capacity of assistant to the president. Mr. Bramman was formerly connected with the American Carbon & Battery Company.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Annealing Furnace for Metals. Richard Masters, Dudley, England. (U. S. No. 1,241,750; Oct. 2, 1917.)

Automatic Sampler. Seward E. Cogswell, Central City, Neb. (U. S. No. 1,241,196; Sept. 25, 1917.)

Belt-Shifting Device. George A. Sexton, Fitchburg, Mass. (U. S. No. 1,241,036; Sept. 25, 1917.)

Blasting Device. Ernest Hutton, Wayland, Ky. (U. S. No. 1,241,386; Sept. 25, 1917.)

Cyanamid—Process of Making Calcium or Other Metal Cyanamid. James Henry Reid, Newark, N. J. (U. S. No. 1,241,020; Sept. 25, 1917.)

Car-Dumping Apparatus. George H. Mueller, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,240,867; Sept. 25, 1917.)

Case-Hardening Material and Process of Making Same. Alfred O. Blaich, Chicago, Ill., assignor to Alfred O. Blaich Company, Chicago, Ill. (U. S. No. 1,241,909; Oct. 2, 1917.)

Chute—Loading and Unloading Chute. Clarence Peterson, Elm Springs, S. D. (U. S. No. 1,241,436; Sept. 25, 1917.)

Classifier. Joseph S. Bartley, Denver, Colo. (U. S. No. 1,240,923; Sept. 25, 1917.)

Compressor. Stephen G. Skinner, Wilmette, Ill. (U. S. No. 1,240,892; Sept. 25, 1917.)

Crucible Furnace. George Keith, London, England, assignor of one-half to James Keith, London, England. (U. S. No. 1,241,397; Sept. 25, 1917.)

Crucible. John C. Henderson, Washington, D. C., assignor to Driver Harris Co., Harrison, N. J. (U. S. No. 1,241,971; Oct. 2, 1917.)

Earth-Boring Machine. John F. Sauerman, Little Rock, Ark., assignor of forty-eight one-hundredths to Ben D. Schaad, Little Rock, Ark. (U. S. No. 1,241,665; Oct. 2, 1917.)

Electrolytic Apparatus. Herbert R. Hanley, Winthrop, Calif., assignor to Bully Hill Copper Mining and Smelting Co. (U. S. No. 1,241,967; Oct. 2, 1917.)

Electric Furnaces, Regulating Apparatus for. Wilfred Sykes, Pittsburgh, Penn., assignor to Westinghouse Electric and Manufacturing Co. (U. S. No. 1,241,574; Oct. 2, 1917.)

Fuel, Process for Manufacturing. John Miller, Seattle, Wash., assignor of one-fourth to Nels Krantz and one-fourth to Hansene Krantz, King county, Wash. (U. S. No. 1,241,648; Oct. 2, 1917.)

Gold-Washing Machine. Jospeh A. Furtado, Half Moon Bay, Calif. (U. S. No. 1,241,954; Oct. 2, 1917.)

Grinding-Mill. Edward F. McCool, Victor, Colo., assignor to The McCool Manufacturing and Trading Co., Victor, Colo. (U. S. No. 1,241,749; Oct. 2, 1917.)

Ingot and Ingot-Mold. Emil Gathmann, Baltimore, Md. (U. S. No. 1,241,618; Oct. 2, 1917.)

Metal-Heating Furnace. Zenas Beldon Leonard, Cleveland, Ohio. (U. S. No. 1,241,526; Oct. 2, 1917.)

Phosphoric Acid — Apparatus for the Manufacture of Phosphoric Acid and Compounds of the Same. William H. Waggaman, Harry Bryan, and Cary R. Wagner, Washington, D. C. (U. S. No. 1,241,791; Oct. 2, 1917.)

Pump—John L. Latta, Hickory, N. C. (U. S. No. 1,237,530; Aug. 21, 1917.)

Silicon — Process of Securing Elements from Their Compounds. Victor M. Weaver, Harrisburg, Penn., assignor to Weaver Company, a Corporation of Wisconsin. (U. S. No. 1,241,796; Oct. 2, 1917.)

Welding-Electrode and Process of Welding. Percy A. E. Armstrong, New York, N. Y., assignor to Walter L. Clark and Arthur H. Adams, a Copartnership under the name of The Quasi-Arc Company, New York, N. Y. (U. S. No. 1,241,899; Oct. 2, 1917.)

Zinc-Extraction Process. Herbert R. Hanley, Winthrop, Calif., assignor to Bully Hill Copper Mining and Smelting Co. (U. S. No. 1,241,966; Oct. 2, 1917.)

Editorial Correspondence

SAN FRANCISCO—OCT. 27

I. W W.'s in Mother Lode Region are few and the mines have been fairly well rid of them. The miners are well paid and well treated throughout the state. It is only the ignorant foreigners that listen to agitators of the I. W. W. clan and they are gradually being disabused of the idea that the mines will soon belong to the I. W. W. A member of that organization at the Fremont mine accosted Samuel Robbins, bookkeeper, for funds to aid striking miners in Arizona. He gave his name as Louis Persoi and said he had been soliciting money from the miners. Upon being accused of being unfriendly to the U. S. Government, Persoi responded with "To hell with the Government." His derogatory remarks precipitated a fight with the result that Persoi was shortly lodged in jail. There is little disturbance in the Mother Lode region, minor outbreaks of this kind being the only ones occurring since the mines closed down last autumn.

Hetch Hetchy Tunneling may develop some of the lower orebodies of the Mother Lode region in Tuolumne County, if the tentative plan said to be under consideration by the City and County of San Francisco shall be carried out. It is reported that City Engineer O'Shaughnessy proposes to abandon all plans for carrying the water along the surface, either by canal or pipe through the higher elevations that intervene between Hetch Hetchy and the San Joaquin Valley. No definite figures are available, but an approximate estimate may be made as to the depth which would be reached by such a bore through the hills along the proposed line. The mines are situated at various elevations from 1500 to 3000 ft. above sea level, or a probable average of 2000 ft., so that such a tunnel would cut away below the mines of ordinary depth. Most of the mines are shallow, a few hundred feet in depth. Rights-of-way are said to have been secured and provision made in the deeds for exploring the tunnel by the owners of the mining claims during the progress of construction. There are about 400 of these rights-of-way, which means that there will be a large amount of prospecting and exploring if the plan is carried out. It may mean the development of great orebodies at the depth of the tunnel, or it may prove that the plane of the tunnel will be on the line of the barren zones that have been encountered in mines that have reached a depth approaching the level of the sea. At any rate the development will be interesting from a geological point of view and the mine owners will profit by the knowledge.

BUTTE—Oct. 27

Raid on Union Headquarters of the "Metal Mine Workers" at Anaconda was made on the afternoon of Oct. 24, resulting in the arrest of J. S. Robertson, president, and of F. H. McDonald, W. J. Anglum and James Canfield. The arrests are supposed to be in line with others made recently by the Federal authorities in this section. The men will be held pending the arrival of a Federal agent. They were charged with interfering with and hampering the production of copper in the district.

Anaconda Operating at 78% Capacity is reported by officials of the company and figures of other mine managers show that all the mines of the district are being operated at over 70% of normal capacity, the Anaconda company having the highest percentage. A statement also shows that the company is shipping to the smeltery at Anaconda 10,000 to 11,000 tons of ore per day. It is stated that 15 shafts are now in operation, but 13 are still idle for want of men. Those still shut down are the Alice, Lexington, Buffalo, Bell, Diamond, Rarus, Tramway, Berkeley, Belmont, Neversweat, St. Lawrence, East Colusa and Silver Bow. Not in the history of Butte mining has labor been so scarce as at present. Even operators of small properties, where working conditions are always good and jobs desirable, have no applicants for employment, and for the first time such employers are compelled to "hustle" for men, instead of the miners "rustling" for jobs. The striking miners, not without a sense of humor and irony, suggest the establishment of a "rustling card" system for employers.

Twenty Million Dollars Loss has been incurred by mining companies and the miners through the strikes that have existed in the Butte district for more than four months, and have cut the production of copper, silver, gold and zinc from 50 to 70%. While conditions are slowly righting themselves, they still are a long way from approaching normal. There will always be many people, who will be of the opinion that, viewed from either the side of the mining companies or the miners, the long-continued trouble has been senseless and useless. The grievances of the miners were long known to everybody before a strike was thought of, and it might have been averted had the requests of the miners been anticipated and granted in the measure that they were conceded after they had been on a strike for a month or more. The next great mistake, always apparent, was made by the authorities—Federal, state and local—in permitting the influx of the vicious, traitorous I. W. W.'s, and allowing them practically free tongues for months in their advocacy of violence, sedition and destruction of property. After these had done all the damage they could and one of their number was lynched, the Federal Government made its long-delayed raid, and that was the end of the I. W. W. influence among the strikers. The great mistake on the part of the miners was in permitting the few vicious I. W. W. and pro-German agents to use them, and advise them to demand the earth and all the fullness thereof. The mine managers refused to deal with the strikers or receive their committees, and so bitterness grew and it still continues, with the end not in sight.

Plan to Prevent Strikes and lockouts of labor during the period of the war is proposed by the Anaconda interests and the Employers' Association of Montana and will be presented to the Federal investigating board when it visits Montana. The plan has already been submitted to President Wilson, Secretary of Labor Wilson and the governor of Montana. It is in effect a compulsory-arbitration scheme, a plan that worked successfully in Montana, including Butte, until the occurrence of the present labor troubles in this city, when both employers and workingmen became so bitter toward each other that negotiations for peace would not be considered. The proposal of the employers' association, of which the Anaconda company is the most important member and chief controlling factor, is the establishment of a national board of arbitration, with local arbitration boards throughout the United States, laying the foundation for an order by the President prohibiting strikes or lockouts from a certain date until the termination of the war, and compelling the submission of all labor disputes for that period. It is suggested that the national board be composed of seven members, three to be selected by Samuel Gompers, one by the Government and three by the employers associations, local boards to be agreed on by the employers and employees, with all matters referred to the national board when local boards cannot reach an agreement. It is proposed that employers support their own members on the board and that labor unions provide for the support of their representatives, while the national board members shall be under salary from the Government. The powers of the boards shall cease on the termination of the war.

DENVER—Oct. 26

Mine Taxation is giving the metal miners considerable cause for complaint at this time. The producers claim that the Government officials who devise methods of taxation are placing an unwarranted burden on the industry, which is producing the metals that are most needed by the Government. Men who control large mining operations and substantial amounts of capital available for investment in mine development and equipment are acting with reserve and extreme caution. Some take a decidedly gloomy view of the situation and say that instead of increasing their operations, as they would like to do, they will be forced to curtail, that they can actually make money by shutting down and waiting until after the war is over and the ill-advised taxation has been removed. It should be apparent to anyone but an incompetent bureaucrat that placing any unnecessary and unfair penalty upon the production of the metals which the Government needs most at this time is suggestive of killing the goose that lays the golden egg, although in this case the egg may sometimes be made of lead or zinc or copper.

SALT LAKE CITY—Oct. 27

Fire Destroys Potash Plant belonging to Minerals Products Corporation at Alunite, six miles west of Marysvale, in Piute County, on the evening of Oct. 25. The fire originated in the coal dryer, and was proceeded by an explosion. The main mill building in which was installed a part of the calciner, the digesters, evaporators and the sacking and loading department for the potassium sulphate, was completely burned. The loss, according to company officials, is placed at about $250,000, which may be reduced $50,000 by salvage of the calciner, digesters and possibly the evaporators. Two stokers, who were working at the coal dryer and rear end of the calciner at the time of the explosion were severly burned. During last May and June there were seven fires of mysterious origin and the company built a fence around the entire plant. This plant was the first successfully operated potash mill in the United States.

WALLACE, IDAHO—Oct. 26

Suit Against Bunker Hill & Sullivan by the American Smelting and Refining Co. in the Federal court was to have been heard in Portland on Oct. 18, but was postponed by agreement to a future date. The plaintiff had asked for an order to restrain Bunker Hill & Sullivan from smelting the ores from the Bunker Hill & Sullivan mine and to force compliance with the contract held by plaintiff under which the defendant is required to ship all ore containing between 30 and 75% lead to the plaintiff's smelting plants, and also ore containing less than 30% and more than 75% under certain stipulated conditions. In the meantime, the Bunker Hill & Sullivan company has filed its answer to the complaint. It consists of supporting affidavits by F. W. Bradley, president of the Bunker Hill & Sullivan company, Stanly A. Easton, general manager, and Myron A. Folsom, chief counsel. The answer reviews the smelting situation in the Cœur d'Alene district and gives in considerable detail the circumstances under which the now famous contract between the contending companies was entered into, alleging violation of the spirit of the contract on various occasions for the purpose of depriving the defendant of the benefit of competition in the sale of its product. On account of these wrongful methods by the smelting company the defendant alleges it has suffered a loss and injury between June 1, 1915, and the date of filing the complaint, in excess of $3,000,000 and demands damages in that sum. The answer prays that the complaint be either dismissed, or that the court determine and adjudge the following: (1) That the rates and terms which defendant should have received since June 1, 1915, are the full New York price for 90% of the lead contained in all the ore shipped, with freight and treatment charge of not exceeding $15 per ton; (2) that plaintiff be first required to do equity by accounting for and paying the amount which defendant has been wrongfully deprived of by plaintiff, which sum, defendant alleges amounts to three million dollars; (3) that plaintiff has no right in the future to any of the defendant's product which may contain 75% in lead or more, or any of defendant's product which may contain 30% lead or less; (4) that by reason of plaintiff's refusal to accept at its smelting plant at Tacoma, Wash., sufficient of defendant's product to yield 37 tons of metallic lead per day, that hereafter defendant may dispose of that amount of its product containing between 30% and 75% in lead, in such manner as it sees fit; (5) that for the present and until conditions of contract and the amendments thereof are changed, the defendant shall not be required to ship any of its product containing between 30% and 75% in lead to said plaintiff, except upon condition that plaintiff pay to the defendant the full New York price for 90% of the lead contents of such shipments, and upon

the further condition that defendant shall not be required to pay in excess of $15 per ton for freight and treatment; (6) fix, determine and adjudge from time to time until the year 1930, upon the application of either party hereto, what better rates and terms the said defendant company shall be entitled to under clause 12 or any other portion of said contract, and that upon such determination this court further determine that defendant shall not be required to ship thereafter until plaintiff shall have complied with such finding; (7) that the court grant such further relief as may seem proper, including costs. In his affidavit Mr. Bradley reviews his negotiations with the smelting company, and states that in 1912 he discovered that the smelting company was arranging its contracts so that they would expire on or before June 1, 1915, the date for revision of the Bunker Hill contract on a basis of the rates given the majority of the ores of the district. It was then that the Bunker Hill company decided to build its own smeltery, and contracts were awarded in the latter part of that year.

JOPLIN—Oct. 27

Wages at Sheet-Ground Mines of this district are not to be cut, despite the fact that the average basis price for blende indicates a cut of 25c. per day per man. Operators of the sheet-ground mines met today at Webb City and after a thorough discussion of the matter, decided to recommend that the schedule of wages, based on the average monthly basis price of blende—a schedule which has been adhered to for over two years in this field with mutual satisfaction to the operators and miners—be violated during November to the extent of keeping wages where they are. The decision to make this recommendation was not unanimous, but was concurred in by the majority of the operators. At the same time they passed and ordered published a resolution in which they cite the fact that the cost of mining has advanced almost 100% in the last two years, while the price of ore in recent months has been dropping steadily. Since the middle of August, lead ore has dropped $70 a ton, and zinc ore $12 a ton. At the same time it is appreciated that the miners are up against an increased cost of living, and it is out of consideration for this fact that the cut in wages will not be made in November. The announcement was made without any threats of a strike in case the cut was made, but it is realized by mining men that the miners cannot live at much less than the prevailing wages. The meeting of operators also considered the proposition of a general shutdown of mines and decided that this was a matter for individual mine owners and operators to decide. A large percentage of the sheet-ground mines are already shut down, and this week for the first time in several years, the shipments of the Webb City-Carterville camp dropped below one million pounds of blende. The Oklahoma camp continues with heavy shipments, but the cut in the price of lead is going to affect that camp materially, as their production proportionately is much greater in lead than the Webb City camp.

TORONTO—Oct. 26

Royalties on Flotation Patents or Dominion control of the patents continues to be agitated by the "Northern Miner," a Cobalt newspaper, which in its campaign for obtaining easier conditions for Cobalt flotation operators, telegraphs as follows: "Hon. Frank Cochrane, who was Minister of Lands, Forests and Mines in Ontario before entering the cabinet of the Dominion government, stated at a 'Win the War' convention in Cobalt on Oct. 24, regarding the patents in flotation held by Minerals Separation North American Corporation in Canada: 'It will be my business to see Sir Robert Borden on the question with a view to bringing them to their senses, and for the benefit of the mining community try to get him to cancel their patents.' He informed the meeting that if, after a thorough investigation it were found that control was not vested in German alien enemies, it would be the duty of the government to see that the royalty imposed was so reasonable that it would in no way embarrass the industry, or retard the developments and production of Canada's metals. In this connection, he suggested that the government would appreciate the advice from mining operators in Canada, as to what in their estimation would be considered a fair and reasonable royalty."

EL PASO—Oct. 27

Chihuahua Properties of the American Smelting and Refining Co. are expected to be partially reopened soon. The company has brought in a shipment of coke preparatory to commencing smelting operations. Under present conditions, the American companies operating in Mexico are doing so under the arrangement made some weeks ago by the Federal Reserve Board to provide the necessary gold for the companies to meet the Carranza demands. Luis Cabrera, a delegate from Mexico, is in the United States, it is understood, for the purpose of getting food for Mexico, and the question of the gold embargo is held up pending the settlement of the former matter.

The Mining News

ARIZONA

Gila County

LAVELL GOLD (Hayden)—Mine situated few miles north of Burns siding purchased by George B. Leighton, president of the Lavell company and eastern men. St. John Smith, treasurer and J. M. Boutwell, consulting engineer. Shipping to El Paso.

Mohave County

UNION BASIN MINING CO. (Golconda)—Mill destroyed by fire. Small force retained. John W. Wanvig, manager.

NEW TENNESSEE MINING CO. (Chloride)—Shaft down 280 ft. Molybdenite showing below 265-ft. level. G. J. Ridenour, superintendent.

MERRIMAC (Chloride)—Installed new compressor and engine. Sinking started Oct. 15 in new shaft, 60 ft. deep. J. P. Ryan, superintendent.

NEW MOHAWK MINING CO. (Chloride)—Struck oreshoot west of shaft. Heavier hoist being installed, present moved to shaft No. 3. J. J. Robertson, manager.

Pima County

WAKEFIELD (Tucson) — Charles P. Reiniger of Mile Wide Copper Co., purchased Wakefield-Belmer group of 19 claims in San Xavier district.

Pinal County

U. S. VANADIUM (Kelvin) — Milling equipment arriving.

TROY ARIZONA (Kelvin) — Climax shaft sunk 430 ft. At 500-ft. level will explore laterally.

GILA DEVELOPMENT (Kelvin)—About 500-ft. development done on the first level, much of it in ore.

SILVER KING (Superior) — Shaft unwatered; timbering and repairing nearly completed. Electric-lighting plant installed. Three miles of wagon road built to connect railroad siding. Finding ore in new drifts from upper workings.

Yavapai County

DUNDEE ARIZONA (Jerome)—Water difficulty seems to be overcome. Working three shifts in shaft making about 2½ ft. daily.

UNITED VERDE COPPER (Jerome)—Ex.-Sen. W. A. Clark and son, C. W. Clark, general manager, present at property for two weeks, reported making arrangements for increasing output, reopening Equator mine and purchasing adjoining property.

NEW YORK VERDE (Jerome)—Organized as successor to Victor Copper Co., with W. W. Lewis, general manager. Latter claims three south end claims of property were to be delivered to him. Suit will be tried in Superior court at Prescott.

CALUMET & JEROME (Jerome)—Sinking winze on 600-ft. level; driving 1-3 drift westward from No. 1 crosscut; winze reported showing chalcopyrite. Will drift eastward under the 2-R and westward when winze is down 150 ft., while connecting shaft by crosscut and raise.

CALIFORNIA

Butte County

EL ORO DREDGING (San Francisco)—Reported to be drilling the Menzel Ranch, north of Redding. Been operating in Oroville field, Butte County, for years.

Calaveras County

SALVADOR (Mokelumne Hill)—Frank Lagomarsino, superintendent, reports new ore developed. Preparing to start mill.

PACIFIC GOLD MINING AND MILLING CO. (Mokelumne Hill)—Permitted to sell 99,500 shares at 50c., for development; also to issue 500 shares to incorporators and 900,000 shares to Max Muller for lode claims and mill sites. Equipped with electric-power plant, ball mill, machinery and surface buildings. Option on Easy Bird included.

Fresno County

COALINGA SYNDICATE OIL CO. (San Francisco)—Permitted to issue 2,499,993 shares for 225 acres in Coalinga district; 2,098,169 shares in escrow with M. B. Harris of Fresno, and 410,824 shares in escrow with Bank of California, at San Francisco, to be delivered upon satisfaction of mortgage.

Inyo County

STANDARD (Bishop)—Marcy mill being put in tungsten plant will bring capacity to 200 tons a day. Expected to mill with less sliming. Tunnel in two new claims at 200 ft. from surface croppings, being advanced. Present figures estimate possible blocking out of 70,000 tons of ore between tunnel planes and croppings. Wages increased to $3.50 per day for common labor, $4 for hand miners and $4.50 for millmen. Increase in accord with advance in tungsten prices. No labor troubles so far.

Kern County

UNION OIL CO. (Bakersfield)—Electrical storm caused firing of 37,000-bbl. oil tank at refinery five miles north of town. Nine other tanks in danger, but change in wind and heavy rain confined fire.

BUTTE (Randsburg)—New 10-stamp mill being improved. Additional plates installed and provision made for cleaning settling tanks. New ore disclosed requires increased capacity and full 24-hour run per day. F. K. Seaman, in charge of mill, and Mr. Taylor, superintendent.

Nevada County

ALLISON RANCH (Grass Valley)—Centrifugal pump, 500-gal. capacity installed on 500-ft. level. Remaining 600 ft. of shaft and several hundred feet of drifts will be unwatered before developing.

WASHINGTON ASBESTOS CO. (Washington)—Repairing old Fairview mill completed. Extensive deposit of asbestos reported. Development by San Francisco and Oakland men.

Plumas County

DINSMORE (Quincy)—Reported R. E. Edgar and associates will sink shaft on gravel deposit recently drilled.

CRESCENT (Crescent Mills)—Reported shaft will be sunk 200 ft. deeper on vein. Recently equipped with hoist, pumps and other machinery and 400-ft. shaft unwatered.

Shasta County

SHASTA KING (Coram)—Owned by Thomas W. Lawson interests, being reopened. Shipping to Mammoth smeltery.

AFTERTHOUGHT (Ingot) — Flotation plant reported to be satisfactory in trial run, after some changes. Development continues; 100 men employed.

BULLY HILL (Winthrop)—Rising Star shaft repaired and developing lower levels; silver-gold ore carrying copper being shipped to Mammoth smeltery at Kennett.

Trinity County

JENNINGS GULCH MINING AND MILLING CO. (San Francisco)—Permitted to issue 5000 shares to David Gove and Robert S. Norris for assignment of leases to placer claims; also to sell W. C. and M. T. Dohrman 5000 shares. Situated in Jennings Gulch district.

Tehama County

TEDOC MINING CO. (Red Bluff)—Completed 11-mile road from chrome mines on Tedoc Mountain to connection with Red

Bluff-Eureka stage road, 40 miles distant from Red Bluff. First load of chrome hauled on Jeffrey-quad motor truck, 51 miles. W. A. T. Agard, superintendent of mines, states company contracted for early shipment of 4000 tons.

Tuolumne County

CONFIDENCE (Sonora) — Installing 100-ton roller mill. Ore disclosed in 800-ft. level. Was good producer.

ELLEN WINTON (Tuolumne) — Mill and improvements destroyed by forest fire. Also large amount of grain, hay and timber, burning over 15-sq.mi. area.

Yuba County

DIBBLE (Smartsville)—Copper ore reported being shipped to Mammoth smeltery. Nevada men may option property.

COLORADO

Clear Creek County

WINDSOR CASTLE (Idaho Springs)—Worked by lessees.

JOSEPHINE (Georgetown) — Shipping high-grade lead ore.

RULER (Georgetown) —Operated by Onondago Mining Co. through Capital tunnel; shipping to Jackson mill, Idaho Springs.

LAKE (Idaho Springs)—Lessees operating mine. Hoist and air lines installed; shipping milling-grade ore to custom mills. Subleasing dump and No. 1 tunnel.

Chaffee County

PARAMOUNT REDUCTION CO. (St. Elmo)—Impounded tailings from stamp mill below St. Elmo, will be retreated in new mill; incline, tramway and bins built. Flora Belle and other ore will be treated.

Gilpin County

HOMER (Central City)—Shaft being sunk another lift. Shipping.

LITTLE MELVIN (Central City)—Bond and lease taken; will be reopened.

PITTSBURG (Central City)—Shipping good-grade gold-copper ore from this Russel Gulch mine.

HAMPTON (Central City) — Situated near Russel Gulch; producer of ore carrying gold, silver, lead and copper.

GILPIN-EUREKA (Central City)—Operating 10-stamp mill; shipping ore also produced. Shaft 1000 ft. deep. E. L. Clark, manager.

ESMERALDA (Silverton) — Sold at trustee's sale to Louis Rosenfield, holder of bonds. Situated in Minnie Gulch; former producer.

RED MOUNTAIN MINES shipping to Silver Lake custom mill and Durango smeltery are Guston, Congress, St. Paul and Koehler Tunnel. Latter operated by Summit Copper Mining and Milling Co.

Gunnison County

FAIRVIEW (Gunnison)—Still driving tunnel.

Lake County

DERRY RANCH GOLD DREDGING (Leadville)—Has just paid its eighth dividend, making a total of 100% to date. Gold produced up to Oct. 1 has amounted to $278,301. Ground averages 28c. per yd.; this is second year of operation; life estimated at five years.

Ouray County

OPHIR (Ouray)—Being developed by local men.

GUSTON (Red Mountain) — Shipping from dump; may be reopened through Joker tunnel.

ROOSEVELT BASIN, near top of range above Sneffles, has had several strikes during summer; will develop until heavy snow falls.

Park County

SHELBY (Alma)—Situated on Mt. Loveland, being reopened by lessees. Shipping lead-zinc ore from old dumps.

San Juan County

BELCHER (Silverton)—Lessees shipping lead-silver ore.

GOLD KING EXTENSION (Silverton) —Tunnel being driven by contract.

DETROIT-COLORADO (Silverton)—Being reopened. J. H. Slattery, in charge.

San Miguel County

CONCENTRATES SHIPMENTS in September from Telluride: Tomboy, 55 cars; Black Bear, 33; Smuggler-Union, 32; Liberty Bell, 11; Carruthers Lease, 1 car; total, 132 cars.

JAPAN FLORA (Telluride) — Lessees working dumps.

ALTA (Telluride)—Kelly 40-hp. truck installed for hauling between Telluride and mine.

SMUGGLER-UNION (Telluride)—Additional equipment being installed at Blue Lake pumping plant.

TOMBOY (Telluride)—Returns for September show mill operated 28 days, crushing 12,000 tons, yielding $24,000 in bullion. Concentrates shipped amounted to $71,400 and expenses $66,200. Profit, $29,900.

LEWIS MINING AND LEASING CO. (Telluride)—Company of local men to reopen Lewis mine, in Blue Lake Basin. Flotation process to be installed. H. C. McClain, superintendent of Liberty Bell, will be manager.

Summit County

WARRIOR'S MARK (Montezuma)—Option secured, and will be operated soon.

JESSIE (Breckenridge) — Milling ore from development work; considerable tonnage being blocked out.

WELLINGTON (Breckenridge) — New vein opened in crosscut from 6th level at depth of 1000 ft.; drifting under way. Mill overhauled, and operating full capacity. Shipping crude ore and concentrates.

Teller County

SEMI-MONTHLY PAY DAY now operative with most of big mines of Cripple Creek district.

QUEEN BESS (Cripple Creek)—Shipments made recently.

DIG GOLD MINING CO. (Cripple Creek) —Electric hoist and compressor installed. Shaft will be sunk 250 ft. deeper.

ECLIPSE (Cripple Creek)—Building incline surface tramway to "low line" switch, where loading will be done since removal of narrow-gage railroad.

PORTLAND (Cripple Creek)—Independence mill treating 1300 to 1400 tons daily, mostly dump ore; all units operating and treating more than expected capacity; recently received first custom ore. Ore from Portland lessees and Stratton's Mining and Development Co. will be treated hereafter. Portland mill treating about 600 tons daily.

MICHIGAN

Copper

QUINCY (Hancock)—Averaging almost 4000 tons daily from 11th to 77th level.

MASS (Mass)—Gaining in men. Costs higher this year but below 21c.

HANCOCK (Hancock)—September production, 350,000 lb. comparing with 334,000 in August.

CALUMET & HECLA (Calumet)—Flotation machines will be built at Minerals Separation's San Francisco plant.

MAYFLOWER-OLD COLONY (Houghton)—Started sinking new shaft with hand drilling below concrete collar, Oct. 9.

MOHAWK (Mohawk)—May reach rock output of 50,000 tons in October. Rock averages 19 lb. copper per ton.

ALLOUEZ (Allouez)—Will show increase in output for 1917. Daily average now 2100 tons of rock, averaging 18 lb. per ton.

SENECA (Calumet)—Contracted with Smith & Sparks for 200-ft. spur to Keeweenaw Central railroad. Constructing powerhouse-machinery foundations.

FRANKLIN (Demmon)—Repairs to old shaft hoist completed. Output of rock for September was 23,000 tons, compared with 27,000 in August. Old shaft has full crew, but more men could be worked at No. 2. Latest report indicates that No. 2 shaft is cleaned out nearly to bottom at 17th level. More men coming in; averaging 1000 tons daily.

AHMEEK (Ahmeek)—Shipped in September, 96,000 tons comparing with 109,000 in August. Decrease because of less working days. Mill treated 300 tons Allouez rock daily, being overflow from Lake No. 2 and Centennial-Allouez mills.

SOUTH LAKE (Houghton)—Produced in September 3500 tons of rock, carrying good copper contents, being 1500 less than August output. Rock sent to Franklin mill at Point Mills. Shipping since Oct. 1 to Winona mill, saving railway haulage. Rock now averages 17 lb. per ton.

MICHIGAN (Rockland)—Over 400 ft. in Ogimah lode on sixth level; drift from crosscut on fourth level disclosing good contents. Butler lode on second and seventh showing fair grades in drift. Sinking to eighth level. Grading for 600-ft. extension of railroad completed and when track is laid, motor-truck haul will be only 1000 ft.

COPPER RANGE (Painesdale)—These mines continue normal production of about 3600 tons daily. In September, sent to mill more than 100,000 tons, averaging 30 lb. Champion mine produced in September 60,000 tons of rock; Baltic, 26,000 tons; Trimountain, 16,000. The company will build 25 double houses more at Champion and 12 at Trimountain, also concrete stack at both the Champion and Trimountain properties for compressor plant.

MINNESOTA

Mesabi Range

STATE ORE ROYALTIES on ore shipped from State lands for quarter just ended will amount to over $460,000, of which $100,000 will be invested in Liberty Loan bonds.

NEWPORT MINING CO. (Grand Rapids) —Has five drills checking properties recently leased near here.

KINNEY (Buhl)—Closed down after shipping throughout season. Steam-shovels working most of summer.

PHILBIN (Hibbing)—Finished shipping and started stockpiling. Operated by Republic Iron and Steel Co.

HAROLD (Carson Lake)—M. A. Hanna Co. preparing to reopen after one year shutdown.

UNION (Virginia)—Incline shaft, down pit side for hoisting remaining ore, built during last season. Operated by Republic Iron and Steel Co.

SELLERS (Hibbing) — Marion steam shovel Co. setting up 300-ton shovel for Oliver Iron Mining Co. in this pit. This is second shovel of this class purchased by company.

WASHOE (Coleraine)—Contract given to A. Guthrie & Co., of St. Paul, for removal of overburden from property north of Walker pit; leased to Pickands, Mather Co. by Northwestern Improvement Co. (Northern Pacific Ry.)

MISSOURI

Joplin District

MIAMI-ADA (Quapaw, Okla.)—Drilling tract southeast of city with good results.

CONSUMERS (Joplin)—Shut down three weeks to rebuild mill hopper. Will start operating Oct. 29.

HUGH McINDOE, until recently mayor of Joplin, has purchased fee north of Waco Mining Co. mill, at Waco.

LITTLE BILL (Joplin)—New mill ready by Nov. 15 on tract west of Chitwood. Disseminated formation at 185 ft.

ARNOLD & BARRY (Quapaw, Okla.)—Will build small mill on Red Feather lease, just north of Quapaw. Shaft down 80 ft.; mining at 60 ft.

OAK ORCHARD (Joplin)—Sold lease on Cox land north of city to Universal Lead and Zinc Co.; will try deep drilling for first time.

BESSIE LEE (Joplin) — Developing shallow lead property, two miles southeast of Duenweg on Byrd land. Drilling shows sheet-ground formation below 20 ft.

WACO MINING (Joplin)—Making 125 tons weekly at Waco camp; operating mill one shift. Heavy water flow keeps operations above 130 ft. Frank Danglade, Webb City, manager.

ADAMS-HICKS (Joplin)—Taken additional 30-acre lease at Jackson hollow and have 925-ft. incline tram to connect new shaft with mill. Gas-engine power entirely.

MALCONA (Joplin)—Mill shaft completed; making 30 tons concentrates weekly, with only one mill shift and ground partly opened. Recovery is 10%. W. R. Davis, Joplin, manager.

PICHER MINING CO. (Joplin)—Subleased on Golden Rod Co.'s tract, south of Picher, Okla., and will move Twin-Cities mill from Carterville to new site. Former stockholders in Twin-Cities, and some Joplin and Wentworth investors interested.

NEW DINERO (Lincolnville, Okla.)—Recently installed James slime tables and enlarged settling tank to recover more from fines. Operating at 89 ft. Pomona pump, handling water successfully. C. W. Gould, Miami, vice president and manager.

JAYHAWK (Miami, Okla.)—Planning construction two mills soon, one on tract north of Lincolnville and other on lease near state line, north of Sequoaah mine, mile east of Picher, Okla. Shafts started on each; in ore at Lincolnville. W. N. Hays, Miami, Okla., president.

MONTANA

Deer Lodge County

PYRENEES MINE in Georgetown district, owned by Clark interests and Clinton H. Moore of Butte, being reopened by Butte leasers under management of J. Clarke Johnstone. Large producer in past when ore was treated on plates until sulphides were reached, preventing profitable treatment.

Granite County

PHILIPSBURG MINING (Philipsburg) —Constructing 300-ton washing plant for low-grade manganese ores.

Jefferson County

MT. WASHINGTON (Wickes)—One car daily, lead-silver ore sent to smeltery.

CRYSTAL (Basin) — Teams hauling ore from Cataract to railroad at Basin, seven miles distant. Developed by tunnel.

Fergus County

PACIFIC DREDGING CO. (Coffee Creek)—New set of bucket lips received for bucket line of this dredge under reconstruction. Dredge removed four miles from Morrison Gulch because of heavy boulders and will be in operation shortly.

BARNES KING (Kendall) — Statement for September production shows: North Moccasin, ore treated, 2476 tons, assaying about $9.10 per ton, bullion produced, $22,-204; Gloster and Shannon, in Lewis and Clark County, ore treated, 4676 tons, bullion produced, $76,570. Shannon ore assayed, $19.40 per ton; Gloster ore, $11.28 per ton.

Lewis and Clark County

CARBONATE HILL (Helena)—Will resume operations in 300-ft. shaft, Oct. 20.

ROCK ROSE (Helena)—Contact lead at 300-ft. level. Galena ore.

THOMAS CRUSE DEVELOPMENT CO. (Helena)—East 500-ft. drift running into larger orebody.

HELENA (Helena)—Shipped 16 cars of silver-lead ore to East Helena smeltery from 300-ft. level.

ECONOMY (Helena)—Electric power to pump out 300-ft. shaft. Crosscutting at present.

CRUSE CONSOLIDATED (Helena)—North 150-ft. drift in copper-silver ore. New 10-drill compressor ordered, and shaft to be sunk to 250-ft. level.

STEMWINDER MINE (Helena)—Shaft down 100 ft. Silver ore, 2½ ft. wide. Drifts at 100-ft. level.

AMALGAMATED MINES CO. (Helena) New corporation owns mines in Lump Gulch, has Free Coinage under bond, and possesses other claims in Nevada. Will pump out 350-ft. shaft.

Madison County

METALLIC (Virginia City)—Five tons of high-grade ore recently shipped from this Barton Gulch mine to mill in Williams Gulch. Shipment of 15 tons lower-grade ore will be made this week to Anaconda smeltery.

Silver Bow County

EAST BUTTE (Butte)—Production for September was 2,203,300 lb. copper, comparing with 1,676,360 lb. in the previous month having resumed smelting operations after 1½ months' shutdown.

GEORGE (Butte)—Present high price of silver caused William Cassidy, of Butte, to reopen this old mine west of Butte. Two cars silver ore ready for shipment. New locations being made in vicinity.

ANACONDA (Butte)—Mines now operating nearly normal capacity; miners working on Oct. 19, 7847 out of a normal of 10,000; on Oct. 18, 11,000 tons hoisted. Several hundred of company's men were drafted into army, and large number enlisted, which makes the total now at work seem as good as could be expected.

TUOLUMNE MINING COMPANY (Butte)—Developing east-side properties, including Main Range and Colusa-Leonard Extension. Leonard vein owned by Anaconda company on west passes through Tuolumne properties, being known as the Spread-Delight in the Main Range property. Has width of 132 ft. on 700-ft. level, shows good copper and silver assays. Additions to surface plants cost $60,000 preparatory to sinking shaft 400 ft. deeper. Shipping from old property on Anaconda hill. Sinking shaft to 1000 ft.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 20 amounted to 9341 tons, valued at $163,467, comparing with 8982 tons the previous week. Producers were: Tonopah Belmont, 2429 tons; Tonopah Mining, 2350 tons; Tonopah Extension, 2380 tons; Jim Butler, 500 tons; West End, 1063 tons; MacNamara, 315 tons; Montana, 116 tons; Rescue, 132 tons; North Star, 56 tons.

MANHATTAN DEXTER MINING (Manhattan)—Juhl-Fogle lease completed 200-ton test in War Eagle mill. Results not available now. Hibbert-Cantwell lease obtained good returns from amalgamation on recent shipment.

UNION AMALGAMATED MINING (Manhattan)—North crosscut on fissure advanced total of 61 ft.; No. 11, north crosscut, east, total of 47 ft.; south crosscut, 61 ft. Development shows two orebodies have come together at 600-ft. level. Swanson oreshoot yet to be proved. Earl shaft, now at depth of 350 ft., will be straightened and enlarged to double compartment with manway. Will connect shaft bottom with 600-ft. level by raise. Intend to remove mill to Litigation Hill, near Earl shaft, and may discard stamps for ball mill.

WHITE CAPS (Manhattan)—East orebody opened from fourth and fifth levels; proved longer on fifth level than above; considerable more width proved on fourth level than expected. East fault cuts off orebody in level above; will not strike fault on fifth level for 120 ft. further. East drift driven 35 ft. on fourth level; preparing to start stoping operations.

OREGON

Jackson County

GALLS CREEK MINING AND DEVELOPMENT (Gold Hill)—American Exploration Co., of Grants Pass, optioned this placer mine, three miles south of here. Ground being exploited by small crew of men. Consists of 200 acres with valuable water rights. Has been mined successfully since 1851. J. Mattison, manager.

BARRON (Ashland)—This gold mine, situated nine miles east of here, sold to H. J. Sallee. Vein is 16 ft. wide, carrying gold, silver and antimony. Workings consist of 750-ft. drift at 200-ft. depth and winze 50 ft. deeper. Carload of tools and machinery arrived. Employing 25 men cleaning out old works. Ore from former operations, ready for shipment, will be hauled to Mistletoe station, thence to Shasta County smelteries. John Kemple, manager.

SOUTH DAKOTA

Lawrence County

SILVER QUEEN (Galena)—Shipped 10 cars of lead-silver ore from dump to smeltery.

DEADWOOD LEAD AND ZINC (Deadwood)—Plan to erect 10-stamp mill. Excavation completed; road being built. Sulphide ore carrying lead, silver, zinc and copper.

Pennington County

DAKOTA CONTINENTAL (Hill City)—Diamond drilling started. Mining suspended awaiting results. Shaft over 200 ft. deep.

UTAH

Beaver County

PALOMA (Milford)—Strike on 900-ft. level reported holding out well. Small amount of ore being mined on 700-ft. also.

CREOLE COPPER (Milford)—Will be operated for company account soon. Stated enough ore opened for shipments of 10 to 15 cars monthly. Owns five patented claims; practically debt free. Shipped 80 cars in 1916 when under lease. J. A. Pederson, president.

Juab County

TINTIC MILLING (Silver City)—Shipping car of bullion, yielding about $30,000 per car, monthly from Dragon Consolidated, Iron Blossom and Colorado ores.

DRAGON CONSOLIDATED (Silver City)—Fluxing iron ores is most of output, with little high-grade ore. September shipments, 184 cars; August, 254; July, 145: total for first six months, 1917, 876 cars.

TINTIC STANDARD (Eureka)—Cash payment of $12,000 for new property recently made. New shaft connected with old workings, at present producing most of output; ventilation improved. Drifted on 1560-ft. level, 400 ft. from new shaft; short distance further a second raise will be made to connect with stope in old workings; has opened considerable ore, allowing increase in output.

CHIEF CONSOLIDATED (Eureka)—Expect electric pumping plant in operation in about three months, also large concrete reservoirs constructed on 1800-, 1200-, and 600-ft. levels.

PLUTUS (Eureka)—This adjoining property acquired by Chief being opened by latter. Cleaning out and repairing Plutus 400-ft. shaft to be widened later, and sunk further.

IRON BLOSSOM (Silver City)—Prospecting showed no new orebodies, but indications reported encouraging. Shipments during September, 75 cars; August, 88; total for first six months 1917, 761 cars.

SOUTH STANDARD (Eureka)—New company to be formed, known as South Standard, to take over United Tintic's and South Standard's ground. E. J. Raddatz, of Tintic Standard, president.

Salt Lake County

EMMA CONSOLIDATED (Alta)—Diamond drilling for old Emma orebodies continues. Most of ore from between 200- and 300-ft. levels. Daily output said to be 60 to 70 tons.

UTAH METAL AND TUNNEL (Bingham)—Mill increased to 450 tons. High-grade and milling ores stated to be increasing. Smelter contract will take output for five years at average price for week preceding delivery of ore.

AMERICAN SMELTING AND REFINING (Murray)—Building stack to be 450-ft. high and 20-ft. inside diameter at top; perforated radial blocks being used, with acid-proof lining to full height, and terra cotta cap.

Utah County

SOUTH PARK (American Fork)—Strike reported in tunnel, widening with depth.

BELLEROPHON (American Fork)—Leased to American Exploration Co.; caved shaft, being retimbered, sunk 30 ft. in fissure in quartzite showing good ore.

PACIFIC (American Fork)—Capacity 200 to 250 tons. Estimate tonnage on dumps will keep mill operating for some time, before drawing on mine. Leased to Fissures Exploration, which has built mill.

Tooele County

WOODMAN MINING (Gold Hill)—Main tunnel at 120-ft. depth in low-grade copper ore carrying gold and silver for 72 ft. Shipping.

SEMINOLE COPPER (Gold Hill)—Stated will build mill to treat molybdenum and tungsten ores available on property. Will also develop showings of lead-silver and copper-gold ore.

WASHINGTON

Pend Oreille County

LEAD AND ZINC CO. (Metaline Falls)—Shipping eight to 10 carloads per month. Increasing capacity to 12 to 15 carloads.

WISCONSIN

DAHL (Cuba City)—Tom Baldwin and the company unwatered property.

OLIVER (Shullsburg)—Leased land of John Lyne and O'Toole estate, two miles south of Shullsburg.

IDA BLENDE (Benton)—W. Eller and others organized company to reopen this old producer at Benton.

CANADA

Ontario

KELSO (Porcupine)—Contracted for diamond drilling property.

ALEXANDRA (Cobalt)—Purchased by the Mining Corporation of Canada.

ANKERITE (Porcupine) — Contracted for sinking three-compartment shaft, 500 ft.

ADANAC (Cobalt)—Calcite vein containing argentite, ruby, and native silver, cut.

WRIGHT HARGRAVES (Kirkland) Lake)—Shafts down 300 ft.; drifting to connect them.

WALDMAN (Cobalt) — Situated on Gillies Limit acquired by Mining Corporation of Canada and development resumed.

MINAKER - KIRKLAND (Kirkland Lake)—Main vein cut at 40-ft. level shows up well. Small mill will be installed.

BUFFALO (Cobalt)—Paying 25c. a share in cash and reducing capital liability by issue of new stock having par of 75c. instead of $1.

McKINLEY-DARRAGH (Cobalt)—About 40 ft. of drifting on 400-ft. level of Cobalt Lake fault vein shows low-grade orebody 6-ft. width.

TRENTON OIL AND GAS CO. (Toronto)—Secured oil leases near Campbellville; begun drilling. H. H. Stubble, in charge.

TECK-HUGHES (Kirkland Lake) — Winze down from 400-ft. level reached a 600-ft. depth. Station being cut; crosscut will be run to connect with main shaft.

LA ROSE MINES, LTD. (Cobalt, Ont.)—Estimated reserves are $4,943,000 compared with $854,836 on Mar. 31. 1915. Operating expenses were $4.78; ore averaged $9.82; extraction over 95%.

CONIAGAS (Cobalt)—Report for year ended Oct. 31 shows mine produced 1,250,-000 oz. silver, a decrease from previous years owing to less high-grade ore. Coniagas Reduction Co. had difficulty in obtaining supplies which restricted operations. About $70,000 spent on Ankerite and Maidens-McDonald claims at Porcupine and contracted for sinking shaft on Ankerite. Will not pay dividend Nov. 1.

MEXICO

ESPERANZA (El Oro, Mex.)—Ore milled in August amounted to 11,325 tons, at estimated net profit of $25,507.

The Market Report

SILVER AND STERLING EXCHANGE

Oct.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Oct.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
25	4.7515	82⅛	41⅞	29	4.7515	84⅛	43
26	4.7515	83¼	42⅜	30	4.7515	90⅜	46
27	4.7515	83¼	42⅜	31	4.7515	90⅛	45⅞

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
				5.25	7⅛
25	*23½	62	5¼	@5.42½	@7⅜
			5.40	5.37½	7⅛
26	*23½	63	@5.50	@5.42½	@7⅜
			5.45	5.42½	7⅛
27	*23½	64	@5.50	@5.50	@7⅜
			5.45	5.42½	7⅛
29	*23½	65	@5.75	@5.50	@7⅜
			5.50	5.42½	7⅛
30	*23½	66	@5.75	@5.62½	@7⅜
			5.50	5.42½	7⅛
31	*23½	66¼	@6.00	5.82½	@7⅛

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c. St. Louis-Pittsburgh, 13.1 cents.

LONDON

Oct.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
25	110	110	125	247½	247½	30½	54
26	110	110	125	247½	247½	30½	54
27							
29	110	110	125	250½	251	30½	54
30	110	110	125	256½	256½	30½	54
31	110	110	125	257½	257½	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.75½. £30½ = 6.474c.; £54 = 11.462c.; £120 = 25.473c.; £137 = 29.082c.; £240 = 50.946c. Variations, £1 = 0.212277c.

Metal Markets

NEW YORK—Oct. 31

The most noteworthy feature of the metal markets this week was the advance in the price of lead on very large transactions, the cut to 5½c. having stimulated buying. Zinc continued dull and stagnant, this market still being under the incubus of accumulating stocks. Tin experienced a sharp advance in a small market owing to scarcity of supplies. Of copper nothing need be said.

Copper — The copper business is going along very smoothly in the hands of the copper producers' committee. Deliveries to the U. S. Government and to the Allies are being made right along, but it is well known that their orders have not yet attained the maximum. In the meanwhile deliveries of copper on old contracts with domestic consumers are being made, but October ends without completion of the full percentage being delivered that producers owed to them, for the simple reason that there was insufficient copper. New business with domestic consumers has been booked only when they could show that it was absolutely needed, and it then was accepted only to the extent that it could be supplied.

The production of the refineries in October was far short of the average monthly rate in 1916, but it was probably larger than in September (although statistical returns for that month were not made) and an increase in November is confidently expected.

The smoothness with which the copper business is proceeding is due largely to the generous coöperation of manufacturers, who are abstaining from demanding what they do not immediately need, who have reduced the stocks in their yards, and who have arranged to conduct their business with a smaller quantity of copper in semi-finished forms in circulation through their works. Copper manufacturers are drifting to larger business with the Government and less for domestic industry. It is inevitable that the Government will soon be using vast quantities of copper and it is only a question of a short time when its plans will have been formulated and will be revealed.

Copper Sheets have been cut 1c. and are quoted at 35c. per lb. for hot rolled, and 1c. higher for cold rolled. Wire has also been reduced, being quoted at 30c. per lb., f.o.b. mill.

Tin—This market advanced sharply from day to day on small transactions, the business is Straits tin being probably not more than 5 to 10 tons per day. However, the supplies were so scarce that even that small demand had an important effect on the market. Banka tin also is scarce and at the close is quoted at 64@65c., while Chinese No. 1 is quoted at 62½@63½c.

Lead — At the very beginning of the week, the market having got its breath following the surprise of the cut by the A. S. & R. Co. to 5½c., large buying developed. Sales reported to us amounted to 15,000 tons and we conjecture that the total business of the week must have been close to 20,000 tons. In this excited market buying and selling was more or less at sixes and sevens, especially at first, when there were some transactions of considerable volume at below 5½c., but by Monday the market found itself and on that day there were large transactions at 5.45c. @ 5.50c. in the morning, and 5¾c. was realized in the afternoon. On Wednesday 6c. was realized for a round lot. December delivery, but the A. S. & R. C. continued to sell at 5½c. for shipment within 30 days.

The transactions of the week included a considerable tonnage for export, France and Canada being the most important foreign buyers. As for the domestic market, a characteristic was the widespread inquiries and large volume of small sales, indicating that distributers were replenishing depleted stocks.

Zinc—This market declined from day to day on relatively small business. Everybody seemed to want to sell, but relatively few caught the business. Others cut prices to what they thought were low figures, but steadily found that someone else was offering lower. Business of the week included one or two small lots for export to France. The explanation of the situation in spelter is perfectly simple. Buyers are conspicuous by their absence, stocks continue to accumulate, and the producers on whose hands they are accumulating prefer to get money rather than to keep spelter. Spelter class A, or high-grade, is quoted at 11½@12½c. Class B, or intermediate, at 10½c.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Aluminum—This market continues dull with small transactions taking place at 37@38c. per lb. for No. 1 ingots at New York.

Antimony—Reports of this market vary, some houses having done a moderate business, while others did none at all. In the latter class were the Chinese and Japanese houses, which declare themselves out of the market at the present level of prices. The tone of the market is somewhat softer, and we quote spot at 14@14½c., and futures, at 13@13½c., c.i.f. in bond.

Bismuth—Unchanged at $3.50 per pound.

Cadmium—This metal is quoted at $1.40@1.60 per pound.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Stocks continue light and the tone of the market firm without any change in quotation of $100@102. San Francisco reports, by telegraph, $100, strong.

Gold, Silver and Platinum

Silver—This market has been very erratic. After touching 41⅞d. in London and 82½c. in New York, it gathered strength, making violent bounds from 84⅜c. to 90⅝c. in New York and is quoted today at 45¾d. in London and 90½c. in New York.

Proposed agreement between U. S. and Mexican governments regarding export of gold and silver has not been ratified by Mexican government.

Mexican dollars at New York: Oct. 25, 62½c.; 26, 63c.; 27, 63c.; 29, 65c.; 30, 69c.; 31, 69c.

Platinum—Active at $103@105.

Palladium—Active at $120@125.

Zinc and Lead Ore Markets

Joplin, Mo., Oct. 27—Blende, per ton, high, $72.60; basis 60% Zn, premium ore, $72.50@75; medium to low, $67.50@60; low, $55; calamine, per ton, 40% Zn, $35; average selling price, all grades of zinc, $56.62 per ton.

Lead, high, $64.10; basis 80% Pb, $60; average selling price, all grades of lead, $59.66 per ton.

Shipments the week: Blende, 8016 tons; calamine, 1005 tons; lead, 550 tons. Value, all ores the week, $543,620.

One purchasing company continues to pay $72.50 to $75 base for ore. Aside from this the highest base is $67.50, with the bulk of ore selling from $65 to $60 base. Ores grading under 55% Zn receive a $55 base, with slimes grading around 50% on a $50 base.

The electric power situation has improved, but coal deliveries are so uncertain that several mills have operated only part time.

Platteville, Wis., Oct. 27—Blende, basis 60% Zn, $65 base for premium grade down to $58 base for medium grade. Lead ore, basis 80% Pb, $60 per ton offered, but no sales are reported and producers are not disposed to sell. Shipments reported for the week are 3342 tons of zinc ore, 75 tons of lead ore, and 528 tons of sulphur ore. For the year to date the figures are: 120,268 tons of zinc ore, 6276 tons of lead ore, and 23,599 tons of sulphur ore. Shipped during the week to separating plants, 3690 tons of zinc ore.

Other Ores

Manganese Ore — Unchanged at $1 per unit for metallurgical ore on the basis of 48% manganese.

Molybdenum Ore—Unchanged at $2.20 per lb. on the basis of 90% molybdenum sulphide.

Pyrites—Spanish lump quoted at 15c. per unit, on basis of 10s. ocean freight, buyer to pay war risk. Ocean rates remain at 35s. for Northern, 40s. for Southern and 42s. 6d. for Gulf ports.

Tungsten Ore—We quote high-grade (70%) unchanged at $23@25. Slightly lower grades are quoted at $20@23. For anything except the highest grades it seemed to be difficult to get the prices that were asked.

Exports of wolframite from Tavoy, Burma, in the month of June were 202 tons 10 cwt., as against 104 tons 17 cwt. in June of last year.

Iron Trade Review

PITTSBURGH—Oct. 30

During the last week a rumor has been circulating widely that the War Industries Board had decided to hold in abeyance its intention to set prices upon the steel products left out in the announcements of Sept. 24 and Oct. 11. The explanation accompanying the rumor is that an understanding had been reached whereby the industry would itself regulate prices for the remaining products. In some quarters the rumor is credited but in most quarters it is still believed that eventually the Board will set prices for tubular goods, wire products and sheets at least, if not for a number of other and relatively minor products as well.

At this writing a meeting of the sheet manufacturers is in session at Pittsburgh, apparently for the purpose of crystallizing sentiment in favor of adopting the sheet prices that the War Industries Board indicated several weeks ago it would countenance, these prices being considerably lower than those first submitted by the mills. To-morrow representatives of the sheet industry are to meet the War Industries Board at Washington, and an official announcement may follow.

A striking feature in the market is the rapid decline of sheets in the open market in the last fortnight. At the top of the sheet advance it was practically impossible to buy blue annealed or black sheets at 8c., while 9c. was paid in many instances. When the basis prices for pig iron and steel were set on Sept. 24, the sheet market was not under 8c. Ten days ago sheets could be bought at fractions under 8c., while last week offerings became numerous at 6c. and this week there are occasional offerings at 5.50c. or a trifle less, with no quotations above 6c. The first price the sheet manufacturers considered for submission to the Government was 6.50c., so that the market has taken the case in its own hands.

The American Steel and Wire Co. has advanced its prices $2 a ton on plain wire and $6 a ton on nails and barb wire, making plain wire 3.25c. and wire nails $3.50. In some quarters this was interpreted as a suggestion to independents to reduce to $3.50 from their $4 price, but the independents show no disposition to do so and thus the wire trade shows no ability to adjust its prices.

The opinion has now become almost unanimous that if there is any readjustment in prices Jan. 1, as Government statements have suggested is possible, the revision will be downward, and in some quarters it is believed it will occur, starting with a reduction in pig iron from $33 to $30.

Trading in steel products is quite limited, being confined chiefly to material required for Government account. There is little pressure to buy, as consumers generally are well covered for the near-by future and neither buyers nor sellers are disposed to do business for late deliveries.

Production of pig iron, and in consequence of steel, continues to be restricted at 10% or more below capacity, almost wholly on account of the shortage in coke. October, usually a record month, has shown practically no improvement.

Pig Iron—The trade still awaits formal statement at Washington as to differentials, if any, between districts, as well as differentials between grades. Meanwhile business is being conducted with considerable freedom on a tentative basis. As a rule producers are refusing to sell except to regular customers as there are suspicions that consumers having iron due them at higher prices are disposed to go elsewhere and seek iron at the Government prices. We quote the market at the set level of $33, valley, for foundry and basic and at the tentative price of $36.30 for bessemer, prices delivered Pittsburgh being 95c. higher.

Ferroalloys

Ferromanganese—With demand limited, and the possibility that the Government may undertake to set ferromanganese at a relatively low price, the market has been declining and is quotable at about $275 for prompt domestic and $250 for first half domestic. Imported remains nominally at $325.

Coke

Connellsville—Production remains at substantially the same rate as formerly, and materially under the requirements, particularly of the furnaces having their own ovens. Offerings in the open market have increased only slightly. The Government has not yet announced a differential for foundry coke and we quote coke in general at the fixed price of $6 a net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 30
Alaska Gold M.	3⅛
Alaska Juneau	3
Am.Sm.& Ref.,com.	81⅛
Am. Sm. & Ref., pf.	102
Am. Sm. Sec., pf., A	94
Am. Sm. Sec., pf. B.	‡93
Am. Zinc	14⅛
Am. Zinc, pf.	40⅛
Anaconda	61⅛
Batopilas Min.	1⅛
Bethlehem Steel	79⅛
Bethlehem Steel, pf.	91
Butte & Superior	19⅛
Cerro de Pasco	31⅛
Chile Cop.	15⅛
Chino	42⅛
Colo.Fuel & Iron	36⅛
Crucible Steel	62⅛
Dome Mines	7⅛
Federal M. & S.	15
Federal M. & S., pf.	36
Great Nor., ore ctf.	27
Greene Cananea	39⅛
Gulf States Steel	93⅛
Homestake	‡95
Inspiration Con.	43
International Nickel	26⅛
Kennecott	32⅛
Lackawanna Steel	77⅛
Miami Copper	30⅛
Nat'l Lead, com.	44⅛
National Lead, pf.	101
Nev. Consol.	18
Ontario Min.	4⅛
Quicksilver	1
Quicksilver, pf.	1⅛
Ray Con	22⅛
Republicl.&S.,com.	75⅛
Republic I. & S., pf.	98⅛
Sloss-Sheffield	39⅛
Tennessee C. & C.	12
U. S. Steel, com.	102⅛
U. S. Steel, pf.	113
Utah Copper	80⅛
Va. Iron C. & C.	56

N. Y. CURB†	Oct. 30
Big Ledge	1⅛
Butte & N. Y.	‡
Butte C. & Z.	8
Butte Detroit	⅛
Caledonia	.52
Calumet & Jerome	1 1⅛
Can. Cop. Corpn	1⅛
Carlisle	‡3⅛
Cashboy	‡.05
Con. Aris. Sm.	1 1⅛
Con. Coppermines	8⅛
Con. Nev.-Utah	‡.08
Emma Con.	⅛
First Nat. Cop.	2⅛
Goldfield Con.	.40
Goldfield Merger	‡.04
Greenmonster	⅛
Hecla Min.	5⅛
Howe Sound	‡4⅛
Jerome Verde	1 1⅛
Kerr Lake	4⅛
Louisiana	⅛
Magma	.38
Majestic	.35
McKinley-Dar-Sa.	.60
Milford	1.10
Mohican	‡.25
Mother Lode	.33
N. Y. & Hond.	‡13
Nipissing Mines	8
Ohio Cop.	‡1
Ray Hercules	13⅛
Richmond	.56
Rochester Mines	.38
St. Joseph Lead	15⅛
Standard S. L.	⅛
Stewart	.28⅛
Success	.13
Tonopah	5⅛
Tonopah Ex.	2
Tribullion	.09⅛
Troy Arizona	.15
United Cop.	.50
United Verde Ext.	33⅛
United Zinc	2⅛
Utica Mines	.15
Yukon Gold	1⅛

SAN FRAN.*	Oct. 30
Alta	.02
Andes	.10
Best & Belcher	.02
Bullion	.01
Caledonia	.07
Challenge Con.	.05
Confidence	.06
Con. Virginia	.09
Gould & Curry	‡.01
Hale & Norcross	.03
Jacket-Cr. Pt.	.03
Mexican	.11
Occidental	.60
Ophir	.12
Overman	.04
Savage	.03
Seg Belcher	‡.02
Sierra Nevada	.11
Union Con.	.95
Utah Con.	.01
Belmont	3.75
Jim Butler	.76
MacNamara	.25
Midway	.09
Mont.-Tonopah	‡.15
North Star	.06
Rescue Eula	.14
West End Con.	.70
Atlanta	.10
Booth	.05
Comb. Frac.	.03
D'field Daisy	‡.02
Florence	.13
Jumbo Extension	.18
Kewanaa	.08
Nevada Hills	.03
Nevada Packard	.21
Round Mountain	.23
Silver Pick	.11
White Caps	.06
Big Jim	‡.50
United Eastern	3.65

BOSTON EXCH.*	Oct. 30
Adventure	1¼
Ahmeek	89
Algomah	.25
Alloues	.55
Aris. Com., ctfs.	.9
Arnold	.25
Bonanza	.21
Butte-Balaklava	.40
Calumet & Aris.	66
Calumet & Hecla	455
Centennial	14
Copper Range	46⅛
Daly West	1⅛
Davis-Daly	3⅛
East Butte	9⅛
Franklin	‡4⅛
Granby	71
Hancock	9⅛
Hedley	‡16⅛
Helvetia	.25
Indiana	1⅛
Isle Royale	25⅛
Keweenaw	1⅛
Lake	6
La Salle	3
Mason Valley	4⅛
Mass	5⅛
Mayflower	1⅛
Michigan	1⅛
Mohawk	66
New Arcadian	2
New Idria	12
North Butte	13⅛
North Lake	.60
Ojibway	1⅛
Old Dominion	38
Osceola	60⅛
Quincy	67
St. Mary's M. L.	57
Santa Fe	.75
Seneca	7
Shannon	5⅞
Shattuck-Ariz.	20
So. Lake	2
So. Utah	.13
Superior	5
Superior & Bost.	3⅛
Trinity	4⅛
Tuolumne	1⅛
U. S. Smelting	48
U. S. Smelt'g, pf.	47⅛
Utah Apex	2⅛
Utah Con.	12⅛
Utah Metal	3
Victoria	2⅛
Winona	‡2
Wolverine	35⅛
Wyandot	.50

BOSTON CURB*	Oct. 30
Alaska Mines Corp.	.25
Bingham Mines	10⅛
Boston Ely	.55
Boston & Mont.	.58
Butte & Lon'n Dev.	12
Calaveras	2
Calumet-Corbin	‡.01
Chief Con.	2⅛
Cortez	.10
Crown Reserve	.24
Crystal Cop.	.52
Eagle & Blue Bell	2⅛
Gila Copper	.17
Houghton Copper	.70
Intermountain	1⅛
Iron Cap, Com.	14
Iron Cap Cop., pf.	14
Mexican Metals	.31
Mines of America	1⅛
Mojave Tungsten	.37
Nat. Zinc & Lead	.30
Nevada-Douglas	1¼
New Baltic	⅛
New Cornelia	15
Oneco	.42
Pacific Mines	.35
Rex Cons.	.10

SALT LAKE*	Oct. 29
Bannack	.26
Big Four	.01
Cardiff	4.50
Colorado Mining	.12
Daly	1.50
Daly-Judge	8.25
Empire Copper	1.27½
Gold Chain	.16½
Grand Central	.55
Iron Blossom	.60
Lower Mammoth	.03
May Day	.04½
Moscow	.11
Prince Con.	.91
Rico Wellington	.13
Silver-King Coal'n	2.90
Silver King Con.	3.75
Sioux Con.	.04
So. Hecla	.94
Tintic Standard	1.45
Uncle Sam	.01½
Wilbert	.21
Yankee	.08

TORONTO*	Oct. 29
Adanac	.15
Bailey	.05
Beaver Con.	.34½
Chambers Ferland	.12
Coniagas	3.40
Hargraves	.08½
La Rose	.37½
Peterson Lake	.10
Temiskaming	.28
Wettlaufer-Lor.	.07
Davidson	.30
Dome Exten.	.11
Dome Lake	.15
Hollinger	4.80
McIntyre	1.37
Newray	.45
Porcu. Crown	.32
Teck-Hughes	.40
Vipond	.32
West Dome	.17

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 30
Cresson Con.	5.00
Doctor Jack Pot	.03
Elkton Con.	.03½
El Paso	.15
Gold Sovereign	.02½
Golden Cycle	1.84½
Granite	‡.40
Isabella	.08
Mary McKinney	.06
Portland	1.10
United Gold M.	.16
Vindicator	.25

LONDON	Oct. 15
Alaska Mexican	‡£0 5s 0d
Alaska Tre'dwell	‡ 1 0 0
Burma Corp.	4 0 7½
Cam & Motor	0 12 0
Camp Bird	0 9 0
El Oro	0 10 6
Esperanza	0 9 0
Mexican Mines	5 17 6
Nechi, pfd.	0 13 0
Oroville	0 18 0
Santa Gert'dis.	0 15 0
Tomboy	0 18 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
Jan.	48.855	56.775	75.630	22.731	26.960	36.682
Feb.	48.477	56.755	77.585	22.753	26.975	37.742
Mar.	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
Aug.	47.163	66.083	85.407	22.780	31.498	43.418
Sept.	48.680	68.515	100.740	23.591	32.584	50.920
Oct.	49.385	67.855		23.925	32.361	
Nov.	51.714	71.604		25.094	34.192	
Dec.	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.962	112.432	130.000	137.455	142.000
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120	25.380	110.283	122.391	126.304	137.000
Sept.	26.855	25.073	113.905	117.500	134.071	135.250
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.579	168.357	242.181
August	38.565	62.681	169.870	243.978
September	38.830	61.542	171.345	244.038
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11.123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	10.594	6.088	10.518	29.734	30.500
September	6.810	8.680	6.699	8.611	30.786	30.500
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.853		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug.	8.730	8.360	8.560	8.190	51.587	54.000
Sept.	8.990	8.136	8.820	7.966	52.095	54.000
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	54.17	18.95	50.37	19.22	53.95
September	22.88	46.40	19.58	42.24	19.53	48.58
October	24.61		21.26		21.51	
November	30.07		28.18		26.85	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.

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